

arboricultural impact assessment report

AIA-01

Revision A, Issued for Planning Proposal
13 May, 2020

DOCUMENT INCLUDES

- TP-01 Tree Retention Value Plan
- TP-02 Tree Protection & Removal Plan
- TP-03 Tree Canopy Pruning Plan

PROJECT

GLEBE MID-RISE PROJECT

31 Cowper St & 2A-2D Wentworth Park Rd
Glebe NSW 2037

CLIENT / PRINCIPAL

NSW Land and Housing Corporation

Locked Bag 4009
Ashfield, NSW 1800



ARTERRA DESIGN PTY LTD ABN 40 069 552 610
SUITE 602, 51 RAWSON STREET, EPPING NSW 2121
P 02 9957 2466 F 02 9957 3977 W ARTERRA.COM.AU

CONTENTS

i	EXECUTIVE SUMMARY	iii
1.0	INTRODUCTION	1
1.1	Background	1
1.2	Aims of This Report.....	3
1.3	Relevant Controls or Legislation	3
1.4	Conduct and Author Qualifications.....	3
1.5	Key Definitions and Abbreviations	3
1.6	Documents Reviewed.....	4
1.7	Site Location, History and Context.....	5
1.8	Site Ownership and Zoning	6
1.9	Assessment Methodology	6
1.10	Pre-Development Tree Assessment – Tree Retention Values.....	7
1.11	Tree Assessment – Tree Protection Zones	7
2.0	KEY FINDINGS & OBSERVATIONS	9
2.1	The Proposed Development.....	9
2.2	Climate and Microclimate	9
2.3	Soils and Landform	10
2.4	Tree Assessment - General	10
2.5	Root Investigation Findings	10
2.6	Tree Biology and Tree Care Basics	11
2.7	Tree Impact Assessment.....	13
2.8	Potential Tree Related Impacts to be Managed During Construction.....	18
3.0	TREE Management RECOMMENDATIONS	19
3.1	Potential Amendments to Site Layout and Design	19
3.2	Canopy Pruning and Methodology	19
3.3	Key Tree Management Recommendations to Reduce Tree Impacts.....	24
3.4	Proposed Tree Protection & Construction Activity Sequencing	24
3.5	Demolition Work Near Trees or within TPAs	25
3.6	Tree Protection Fencing & Definition of TPAs	25
3.7	Ground Protection within TPAs.....	25
3.8	Trunk and Lower Branch Protection	25
3.9	Provision of Temporary Irrigation.....	26
3.10	Final Landscaping within TPAs	26
3.11	Final Building and Pedestrian Clearance Pruning	26
3.12	Other Tree Protection Measures to be Implemented.....	27
3.13	References.....	27
4.0	APPENDICES	28
4.1	TP-01 Tree Retention Value Plan.....	29
4.2	TP-02 Tree Protection and Removal Plan	30
4.3	Tree Canopy Pruning Plan.....	31
4.4	Tree Impact Assessment Schedule	32
4.5	Tree Data Summary Sheets.....	33

i EXECUTIVE SUMMARY

On the 8 November 2019, Arterra Design was engaged by NSW Land and Housing Corporation (LAHC) to undertake an arboricultural assessment of 31 Cowper St & 2A-2D Wentworth Park Rd, Glebe (the site) and prepare the relevant reports and plans to help guide the proposed development.

A tree assessment and impact schedule was completed for all the trees. (Refer to Appendix 4.4 – Tree Impact Assessment Schedule). The trees were photographed and given a unique identification number and plotted onto a scaled survey base plan for referencing and identification throughout the report and for future discussions and co-ordination with contractors and stakeholders.

Exploratory root investigations were undertaken adjacent to a large street tree on Cowper Street to ascertain the level of impact that may be sustained by that tree. Also 3D LiDAR scans were completed for the 3 main trees impacted by the proposed development to allow accurate assessment of tree conflicts and required pruning. This has included a detailed assessment of building, piling and scaffold clearances by Arterra.

The following is a summary of the trees found on the site and some relevant factors regarding development of the site.

- **23** trees are currently recorded and assessed on, or immediately adjacent to the two sites.
- **14** trees are located within the sites (with all but 1 small palm tree within the southern portion).
- **9** trees are located outside the site boundaries and are either adjoining street or park trees.
- **7** trees are palms trees that are in good condition and could potentially be transplanted and used within the site final landscaping.
- **6** trees are rated as 'high' retention value and should be targeted for protection and retention. All of these 'high' value trees are located outside the site.
- **11** trees are rated with a moderate retention value.
- **6** trees have a low retention value and should therefore not constrain the development outcomes.
- None of the trees are rated as very low retention value or with serious defects that warrant immediate attention or removal.

Of the **23** trees assessed:-

- **6** trees are recommended for removal due to being within the footprint of the proposed works;
- **7** palms are recommended to be considered for transplanting and use within the final site landscaping;
- **5** trees have no, or minimal, foreseeable impacts from the construction related activity;
- **5** trees have minor encroachments as defined under AS 4970;

The most significant trees relating to the site are the adjoining street and park trees. This includes T01 on Wentworth Park Road, T02-T05 along Mitchell Lane (within MJ Doherty Reserve), and T13-16 along Cowper Street. T13 is a very large *Grevillea robusta* (Silky Oak) while the other trees along Cowper Street are smaller *Stenocarpus sinuatus* (Qld Firewheel Tree). All of these trees are proposed to be retained and protected as well as one significant tree in the south-west corner of the site.

Two of the adjoining street trees are required to be pruned to facilitate the proposed development. Additional information on the required canopy pruning needed for T01 (*Platanus x acerifolia*) and T13 (*Grevillea robusta*) in order to facilitate the construction of the new development has been provided as part of this report. This clearly identifies the branches that are to be pruned, which in the author's opinion maintains a reasonable and acceptable level of pruning.

As with all aspects in the development and construction process, the tree related constraints have to be weighed up against many other relevant development opportunities and constraints. The retention of the trees on the site must also consider economic, social, environmental, construction and practical realities. This document has been prepared by Arterra Design Pty Ltd, using the expertise of our in-house consulting arborist (AQF Level 5), Robert Smart. Robert is a member of the International Society of Arboriculture - Australian Chapter and is also a Registered Consulting Arborist with Arboriculture Australia.



Robert Smart AAILA , ISA, AA

Director, Registered Landscape Architect (054), Registered Consulting Arborist (1804).

1.0 INTRODUCTION

1.1 Background

On the 8 November 2019, Arterra Design was engaged by NSW Land and Housing Corporation (LAHC) to undertake an arboricultural assessment of 31 Cowper St & 2A-2D Wentworth Park Rd, Glebe (the site) and prepare the relevant reports and plans to help guide the proposed development. This assessment was restricted to the trees within or immediately adjacent to the site that were likely to be impacted by the proposed works. Other nearby trees, unlikely to be impacted are not specifically addressed as part of this report.

On 11 November 2019 and 21 January 2020, Rob Smart and Chloe Bristow of Arterra completed a "Pre-development Assessment" of the trees likely to be impacted by the proposed works, identified the trees and ranked their relative significance, health and retention values. This work was distributed to the client and the design team to help guide the development proposal.



Figure 1 – Site context – approximate site outline shown in red (Source: Nearmap)

The client proposes to redevelop the site as a mid-rise, mixed-use development, comprising commercial use with private, affordable and social housing. 2A-2D Wentworth Park Road will comprise primarily social housing while 31 Cowper Street will comprise primarily private dwellings.

The proposed works are likely to have a range of impacts on the surrounding mature trees and particularly upon:

- Street tree T01 *Platanus acerifolia* (Plane Tree),
- Street tree T13 *Grevillea robusta* (Silky Oak) and;
- T06 *Corymbia maculata* (Spotted Gum) situated on the south western corner of the site.

The likely tree impacts are discussed in more detail in **Section 2.7**.

The impact assessment has been prepared to clearly identify the trees to be retained and removed as part of the development and so that Land and Housing Corporation (LAHC) can take a proactive approach to the management of the trees to be retained and put in place appropriate measures to protect them during construction.



Figure 2 – Typical photo of the site and conditions. Many of the existing trees are located around the periphery of the site or on the adjoining street. There is a small group of trees located in the central courtyard of the southern buildings. View is to the west from Cowper Street with T13 *Grevillea robusta* to the centre of the frame. (Photo: Arterra 11/11/19)



Figure 3 – 2 Wentworth Park Road. Note *Platanus x acerifolia* (London Plane Tree) street tree (T01). (Image: Arterra, Nov. 2019)

1.2 Aims of This Report

The aim of this report is to assess the impact of the new development on the existing trees within, or near, the site. Specifically, the report aims to:-

- Assess the health and condition of the trees;
- Accurately record information relevant to the existing trees;
- Assess the significance, Safe Useful Life Expectancy (SULE) and retention values of the existing trees;
- Provide clear recommendations as to which trees should ideally be retained and protected;
- Identify the proposed Tree Protection Zones (TPZ) of the trees being retained and identify and assess the likely arboricultural impacts of the development on the trees and
- Provide advice on the tree protection measures that will be required during construction to ensure the trees are successfully retained.

The following limitations apply to this report's use: -

1. Plans: All plans are based on information provided to Arterra. They should only be used relating to tree issues and are not suitable for any other purpose.
2. Notification of proposed alterations to disturbance within TPZs: Arterra must be clearly notified of any proposed alterations to the plans or additional disturbance in TPZs, so that we can advise on the implications before any work is undertaken.

1.3 Relevant Controls or Legislation

The site is currently owned and managed by LAHC. The site is currently zoned R1 (General Housing) under City of Sydney Council LEP 2012 Land Zoning Map (Sheet LZN_008) (<http://www.legislation.nsw.gov.au> accessed 11/11/2019).

The CoS – Sydney DCP 2012, i Section 3 General Provisions - 3.5.3, Tree Management, applies to trees and vegetation within the LGA. This section states:

1. "a permit or development consent is required to ringbark, cut down, top, lop, prune, remove, injure or wilfully destroy any tree or other vegetation to which this development control plan applies if:
 - The tree has a height of, or greater than, five (5) metres;
 - Has a canopy spread of over five (5) metres;
 - The tree has a trunk girth of, or greater than, 300mm at ground level; or
 - Is listed in the CoS Register of Significant Trees."
2. Under Clause 5.10 of the Sydney LEP 2012, development consent is required for certain activities affecting a tree which is a heritage item or a tree within a heritage conservation area. However, this requirement may be waived if (a)the criteria in clause 5.10(3) of the Sydney LEP 2012 are satisfied; and (b)the work relates to a tree or activity to which provision (1) does not apply.

1.4 Conduct and Author Qualifications

Given the above stated aims of this report, as author of this report, Arterra Design confirms that Robert Smart is suitably qualified (AQF 5 Consulting Arborist) to provide comment and the required arboricultural advice pertaining to these matters.

Furthermore, Mr Smart confirms that he has read and agrees to be bound by the NSW Uniform Civil Procedure Rules 2005, Part 31 Division 2 Provisions, Schedule 7 - Expert witness code of conduct.

Arterra provides specialist consulting arborist services only and does not provide any physical tree work services such as climbing, pruning, removal, root investigations or root pruning. Our advice is based on impartial professional assessment only, as we do not derive any financial benefit from specifying pruning or other physical services. We will not specify any such activities unless we determine them to be essential to ongoing tree health or stability.

1.5 Key Definitions and Abbreviations

The following abbreviations are used throughout this report.

"TPZ" = Tree Protect Zone

This is the area as defined by AS 4970 – "Protection of Trees on Development Sites" and means the typical minimum area above and below ground at a given distance from the trunk to provide for protection of the tree. Most importantly it represents the root zone required to be left undisturbed to maintain a healthy and viable tree. Please note, that roots will usually extend well beyond this zone, so this represents the minimum remaining root zone required, assuming all others are lost or damaged due to construction. It is typically calculated as a circle centred on the trunk unless existing site conditions can be assessed and indicate otherwise.

“TPA” = Tree Protection Area

Although based on the nominal TPZ above, this is a consolidated and often simplified area to be applied during construction for tree protection. This area is often shaped to deal with practical construction realities whilst maintaining appropriate protection of the nominal TPZ (i.e fencing a nominal circular TPZ can be difficult and impractical. TPA areas often define a square or rectangular shape which includes the area calculated as the nominal TPZ). It often amalgamates and simplifies tree protection zones, particularly when they are overlapping and can be amended for items such as buildings, walls, pathways and existing fences. It also protects areas that are contiguous to the calculated nominal TPZ, which are to be applied when the nominal TPZ is not completely circular due to structures potentially impeding root growth, or when there is an incursion calculated within the TPZ.

“SRZ” = Structural Root Zone

This is the area as defined by AS 4970 – “Protection of Trees on Development Sites” and means the area immediately around the base of the tree at a given distance from the trunk within which the woody roots and soil cohesion are considered vital to the structural stability of the tree. Disturbance, damage or removal of soil and roots within this area will typically render the tree unstable and require its removal. It is typically calculated as a circle, centred on the trunk, unless existing site conditions can be assessed and indicate otherwise.

DBH = Diameter at Breast Height

This is the diameter of the trunk measured at 1.4m above ground level.

DGL = Diameter at Ground Level

This is the diameter of the trunk measured at ground level, but just above any root flare.

Non-Destructive Digging

This is the process of safely excavating the ground surface to minimise the risk of damage to existing tree roots. This method is used to map and locate existing tree roots within the TPZ and/or SRZ and helps to guide and inform the installation and/or construction of proposed services and/or structures which are in close proximity to retained trees. This is often achieved through hand digging using a shovel, trowel and/or fork with care not to damage the bark and wood of any roots. Compressed air (air spade) or water vacuum extraction are appropriate non-destructive alternatives to hand digging. When this work occurs within a TPZ and/or SRZ of a tree to be retained, a consulting arborist should always be present to monitor the works.

Inclusion or Included Bark Branch Union

Growth of bark at the interface of two or more branches on the inner side of the branch union which is unable to be lost from the tree and accumulates, or is trapped, between the acutely divergent branches. This can form a weakened branch union in some species.

Epicormic Growth

Juvenile shoots produced along branches or trunks from dormant or latent buds concealed beneath bark. Production can be stimulated by fire, pruning, wounding or root damage and may also be an indicator of tree stress or decline.

LiDAR

This is an acronym for Light Detection and Ranging. Also known as 3D laser scanning, this technology provides extremely precise control and visualisation through scanning and creation of ‘digital point clouds’ of three dimensional objects such as trees, buildings and terrains.

1.6 Documents Reviewed

Plans and documents referenced and reviewed as part of this tree impact assessment were:-
Mepstead & Associates:-

- Plan of Detail and Levels, 17-31 Cowper Street, Glebe
Drawing No. 5743-DET1_B, Survey Dated 18/12/2018

Veris:-

- Plan of Detail and Levels, 2 Wentworth Park Road, Glebe.
Drawing Ref No. 201704, Issue 1. Dated 19/08/2019

Donnelley Simpson Cleary:-

Infrastructure Assessment for Electrical, Communication and Hydraulic Services. Dated 11/05/2020

JPW:-

- Architectural Plan Set Glebe Mid Rise Project, Dated 1/05/2020
- A-1000 Basement Level 02
- A-1001 Basement Level 01
- A-1010 Ground Level

- A-1012 Level 02
- A-1013 Level 03
- A-1014 Level 04-05
- A-1016 Level 06
- A-1017 Level 07
- IFC – 3D Model File dated 7 May 2020

Based on the infrastructure assessment and the architectural plans we are satisfied that the proposed servicing for the development can be achieved and designed to avoid major trenching or disturbance to the existing trees proposed to be retained. We understand that no new services are proposed to be extended into or through the proposed TPAs and any existing services that are no longer required will be capped off and left in situ if located under trees to be retained.

1.7 Site Location, History and Context

The site is located approximately 3km from the CBD, 1.4km from Black Wattle Bay. Wentworth Park is immediately across Wentworth Park Road to the north. 31 Cowper Street is currently an existing residential flat building, broadly square shaped, 2 storey walk up with 3 wings of residences facing Cowper Street, Wentworth Street and Mitchell Lane respectively, with garages accessed from Park Lane. There is a central quadrangle common area with gardens, several mature trees and a water feature, while other trees are scattered around the periphery of the site. A large, mature *Grevillea robusta* (Silky Oak) street tree is situated immediately adjacent to the site, in the Cowper Street footpath, approximately 2m from the boundary wall and 8.5m from the corner of Mitchell Lane.

2A-2D Wentworth Park Road is the smaller portion of the overall site and comprises four, two storey terrace houses with carparking and rear lane access from Park Lane. Their frontage is north east, towards Wentworth Park. The current buildings appear from their style and construction, to date from sometime around the 1970s. A large, mature *Platanus x acerifolia* (London Plane Tree), street tree, is growing in the Wentworth Park Road footpath, approximately 2.5m off the site boundary and 4.0m from the intersection with Mitchell Lane.



Figure 4 – The site (outlined in red) and immediate surrounds as they appeared in 1943. (Image: Sixmaps).

The 1943 aerial photograph of Sydney shows the site as cleared, vacant lots with no trees on the site or within the streets adjoining. The surrounding area appears, with the exception of Wentworth Park, to be a mix of commercial, industrial and warehouse buildings interspersed with terraced housing typical of the area in the 1800s and early 1900s.

The trees along Cowper Street also form part of a heritage listed group of street trees in a heritage listed item (I670) under the Local Environmental Plan (LEP) 2012. This includes trees such as *Grevillea robusta* (Silky Oak), *Flindersia australis* (Australian Teak) and *Castanospermum australe* (Moreton Bay Chestnut) species. Their significance relates to environmental amenity and the use of these rainforest species reflects influences of the Sydney City Council circa 1950. They represent a rare use of these species in previous Leichhardt Municipality. The site and the general area to the west of Cowper Street are also demarcated as a Heritage Conservation Precinct. (C32)

1.8 Site Ownership and Zoning

The site is owned and managed by LAHC. The site is identified as Lots 17 & 18 of DP 244897. Lot 17 has an area of approximately 1163m² and Lot 18 an area of approximately 626m².

The site is currently zoned R1 (General Housing) under City of Sydney Council LEP 2012 Land Zoning Map (Sheet LZN_008) (<http://www.legislation.nsw.gov.au> accessed 11/11/2019).

1.9 Assessment Methodology

On the 11 November 2019 and 21 January 2020, Robert Smart and Chloe Bristow of Arterra attended the site to undertake a detailed assessment of trees located within and immediately adjacent to the site and likely to be impacted by the proposed development. The trees' health and condition were assessed via a visual inspection undertaken from the ground only. Requisite tree data (including DBH, DGL, height & canopy spread, condition & proximity to services) were recorded using an Apple iPad and Filemaker Pro database.

The basic health and condition criteria that were inspected for each tree is summarised as follows: -

- Tree size, broad age-class and general balance of the tree;
- Above ground obstructions;
- Evidence of recent site disturbance;
- Canopy foliage size, colour and density;
- Dieback and epicormic growth;
- Trunk or branch wounding, branch tear outs and pruning history;
- Structural defects such as any co-dominant stems, cracks, splits, included bark, decay and
- Pests and disease evidence or occurrence.

All trees were photographed and given a unique identification number and plotted onto a scaled base plan for referencing and identification throughout the report and for future discussions and co-ordination. The photographic record of trees and general site context was taken using the inbuilt Apple iPad camera and a Panasonic Lumix TZ220 digital camera. Files have been resized, dated, named and filed in accordance with normal office procedures and protocols. No other image manipulation has been undertaken.

Tree trunk diameters were measured using a metric diameter tape measure. Tree heights were measured using the two-point clinometer function of a Nikon Forestry Pro laser range finder. Canopy spreads were estimated by pacing out distances along the cardinal axis of the canopy and cross-referencing to survey information and aerial photos. Canopy position and extents were then altered on the plans to more accurately portray the canopy extent and position.

On the 21 January 2020 non-destructive exploratory excavations using hand excavation and air spade were carried out by Arterra to determine the location, size and condition of roots associated with the *Grevillea robusta* (Silky Oak) street tree (T13).

On the 2 March 2020, LTS Surveyors were engaged by Arterra to undertake 3D Lidar scans of the 3 main trees adjoining and within the site (being T01, T06, T13). LTS attended the site and set up equipment to laser scan the trees to provide a survey accurate point-cloud of the trees foliage and branch structures. LTS processed the point cloud data suitable for input into Arterra's CAD software so that the impacts of the building work could be properly and fully addressed and also conveyed to relevant consent authorities.

No detailed soil laboratory testing was undertaken and no specialised equipment or methods were employed to test for the extent of decay in any of the trees, apart from a nylon 'sounding' mallet. No plant samples were analysed or independently tested to verify or formally identify any pests or diseases.

Desktop Review and Research

Digital AutoCAD and IFC files of the proposed works were imported into Arterra's standard CAD software (ArchiCAD v21) and superimposed over the tree and site survey information. The extent of site disturbance was analysed for the proposed building works, landscaping, services and other site grading. An assessment was made of the likely extent of impacts on the TPZs, taking into account the likely construction impacts depending on the type of work being undertaken (ie: cut or fill, suspended slabs, decks, service trenches). Various area calculations and measurements were made in the CAD software of the likely incursions into the TPZs or SRZs.

3D point cloud data of existing trees in relation to proposed building and scaffolding was analysed by Arterra in 3D CAD software.

Recent aerial photography data was obtained from the Nearmap website with aerial photos of the site dating from 23 October 2018 imported into the above software for cross checking and assessment. (<http://www.nearmap.com/> accessed 09/11/2019)

Climatic data was obtained from the Bureau of Meteorology using statistics from Observatory Hill which is located 2.50km to the north east of the site. (<http://www.bom.gov.au/climate/data/> accessed 11/11/2019)

1.10 Pre-Development Tree Assessment – Tree Retention Values

The information gathered in the field was tabulated and the retention value and tree risk assessed using a combination of techniques commonly used and recognised in the arboricultural industry. The tree life expectancy was established using the Safe Useful Life Expectance (SULE) system. A brief summary of these systems is provided below.

SULE

This is a system developed by Jeremy Barrell in 1993 that determines the time a tree may be expected to be retained based on its age, health, condition, safety and location. This is then moderated by the economics of maintenance or other costs of retaining the tree. A long SULE means the tree is presently expected to live longer than 40 years with minimal intervention and cost. A short SULE indicates a tree that is not expected to live longer than 5 years or may require substantial intervention or costs to retain it.

RETENTION VALUE

The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree.

Each tree was then ranked according to one of 4 retention categories.

1. **"High" Retention Value** – these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They may also be lesser quality trees, but part of an important grouping of trees. They should represent a serious physical constraint to the development and their removal avoided where possible and feasible.
2. **"Moderate" Retention Value** – these are trees that are in good to reasonable condition and should be retained where possible and feasible to do so. They may also be lesser trees, but part of an important grouping of trees and therefore warrant retention based on the group's value.
3. **"Low" Retention Value** – these are trees that are in poor condition or have structural defects, are particularly small or commonplace, are not historically, environmentally or socially significant and should not be considered as a constraint to the development. They could be retained only if they are not likely to be impacted by, or constrain potential desirable, development outcomes.
4. **"Should Remove" / No Retention Value** – these are trees that are in very poor health, exhibit poor form, or have serious structural defects, are considered weeds or combination of all these, and therefore should be considered for removal regardless of any development.

Consideration has also been given to the relationship of the trees to one and other and their proximity to the likely development areas on the site. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees and structures are considered with these factors in mind.

1.11 Tree Assessment – Tree Protection Zones

In order to ensure the long-term survival and growth of any tree to be retained on the development site, a suitable area is required to be protected around the tree. This area should typically be as large as possible. It should also take into consideration: -

- The size and age of the tree;
- Above and below ground properties;
- The health and condition of the tree;
- The species of tree and its tolerance to disturbance;
- Soil conditions, type, depth and site hydrology and

- Site specific conditions and any existing obstructions to root development

The Tree Protection Zones (TPZs) have been calculated using the formula and criteria outlined in AS 4970-2009 Protection of Trees on Development Sites. In summary the standard applies the calculation for the radius of the TPZ as 12 x (the tree trunk diameter (in metres) calculated at breast height (DBH)). DBH is taken at 1.4m above ground level.

A maximum TPZ radius will be 15m (unless crown protection is required) while the minimum TPZ radius shall be 2m.

The TPZ is typically assumed to be radial and centred on the centre of the tree's trunk unless other site factors or tree canopy size and location dictate an adjustment. Encroachments of up to 10% of the area may be accepted within the TPZ as long as it is outside of the Structural Root Zone (SRZ). This is known as a "minor encroachment". Encroachments greater than this, known as "major encroachments" will only be accepted with additional specific evidence that the tree will not be unduly impacted.

Whenever an encroachment is made into a TPZ, a suitable compensation should be made elsewhere and physically contiguous to the remaining TPZ.

The Structural Root Zone (SRZ) is the area defined as the minimum area required to retain the structural stability of the tree. The formula for calculating the SRZ is outlined in AS 4970 Section 3.3.5. No encroachment into the SRZ shall typically be allowed.

2.0 KEY FINDINGS & OBSERVATIONS

2.1 The Proposed Development

The proposed building and development will result in a major site disturbance. All structures across both 31 Cowper Street and 2A-2D Wentworth Park Road are to be demolished with the Cowper Street lot to be substantially excavated to accommodate basement parking. This will require the removal of all but one tree within the north and south sites.

Specifically, the proposed development will involve:-

- Major demolition works;
- Use of large scale civil and earthmoving equipment;
- Access to and from the site with large trucks and construction plant;
- Major excavations;
- Large stockpiles of excavated material and demolition waste;
- Stockpiles/ storage of building materials;
- Regrading and filling of the surface levels;
- Trenching for services;
- Major building works involving concreting, painting and general construction;
- Use of large cranes;
- Parking for site personnel and deliveries;
- Paving and retaining walls and
- Landscaping.

Key Assumptions:-

- All excavations are to be undertaken and retained using sheet, soldier or contiguous piling techniques. Even relatively small excavations, when done near trees are to be retained using soldier piling or similar.
- Despite the above, the line of disturbance outside of the building line has been typically estimated at 2.0m from the face of the building to allow for provision of water proofing, services, access and scaffolding around the building during construction.
- All services for the building will be routed to be clear of any retained trees TPAs
- All construction access and deliveries are to be made from existing roads. Concrete will typically be pumped and will not require any truck movements through TPAs.
- Where no spot levels are indicated it is assumed that the existing surface levels are retained.
- It is assumed that any new landscape grading within the TPAs will be minimal.
- That traditional cantilevered retaining wall footings will be used (ie: footings extending to the rear of the face of the wall, typically equalling the height of the wall).

2.2 Climate and Microclimate

Glebe, is in Sydney's inner western suburbs, and therefore would share the general climate of this region with moderate temperatures, good rainfall and minimal climatic and weather extremes. It is typically described as a temperate climate with hot to warm summers and cool winters, with relatively uniform rainfalls greater than 800mm / year. There is no distinct dry season.

Glebe is located adjacent to Blackwattle Bay on Sydney Harbour and approximately 8.6 km west from the ocean and the coastal cliffs of Dover Heights. It has an approximate average annual rainfall of 1200mm, fairly evenly spread across the year but with a slightly drier period during the late winter and early spring months. The highest rainfall period is usually June with an average of 130mm and the driest month being September with an average of less than 70mm.

Maximum average daily temperatures range from 26.0°C in January and to 16.4°C in July. The minimum average daily temperatures range from a high of 18.9°C in February down to lows of 8.1°C in July.

The primary wind direction is from the south to the north-east in the afternoons while it is predominantly from the west and north-west in the mornings. This is common of coastal areas dominated by "sea breeze" affects. Review of climate data indicates that the primary direction for strong winds is from the west and in the afternoons.

There are no microclimatic influences that would be considered unusual for an intensively developed urban area. The strongest winds (>40km/h) are normally experienced from the south or westerly directions and later in the day.

2.3 Soils and Landform

The natural soils of the area would be expected to be of the Gynea soil association, however the historic and ongoing development of the area is likely to have seen the natural soils being extensively disturbed and modified. Naturally the soils would have been earthy sands with a very apedal and porous structure and acidic pH. The fertility would have been naturally very low.

2.4 Tree Assessment - General

A total of **23** trees were assessed for this report and most were generally determined to be in fair to good health. They are mostly mature trees located on the perimeter of the site, within the verge or within the adjacent park. There are also a small group of trees located within the central courtyard of 17-31 Cowper Street. Most of the trees appear to have been deliberately planted.

Table 1 below summarises the key details for each tree assessed. Detailed information on each tree including; heights, trunk diameters, canopy spreads, age classes and condition are all provided in Appendix 4.4 - 'Tree Impact Assessment Schedule'.

Table 1 – Tree Data Summary

Tree ID#	Botanic Name	Common Name	Retention Value	Recommendation
1	<i>Platanus x acerifolia</i>	London Plane	High	Retain and Protect
2	<i>Platanus x acerifolia</i>	London Plane	High	Retain and Protect
3	<i>Platanus x acerifolia</i>	London Plane	High	Retain and Protect
4	<i>Platanus x acerifolia</i>	London Plane	High	Retain and Protect
5	<i>Platanus x acerifolia</i>	London Plane	High	Retain and Protect
6	<i>Corymbia maculata</i>	Spotted Gum	Moderate	Retain and Protect
7	<i>Corymbia maculata</i>	Spotted Gum	Moderate	Remove
8	<i>Acacia elata</i>	Mountain Cedar Wattle	Low	Remove
9	<i>Washingtonia robusta</i>	Washington Palm	Moderate	Transplant
10	<i>Washingtonia robusta</i>	Washington Palm	Moderate	Transplant
11	<i>Washingtonia robusta</i>	Washington Palm	Moderate	Transplant
12	<i>Sapium sebiferum</i>	Chinese Tallow Tree	Low	Remove
13	<i>Grevillea robusta</i>	Silky Oak	Moderate	Retain and Protect
14	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	High	Retain and Protect
15	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	Moderate	Retain and Protect
16	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	Moderate	Retain and Protect
17	<i>Corymbia citriodora</i>	Lemon Scented Gum	Moderate	Remove
18	<i>Corymbia citriodora</i>	Lemon Scented Gum	Moderate	Remove
19	<i>Corymbia citriodora</i>	Lemon Scented Gum	Moderate	Remove
20	<i>Howea forsteriana</i>	Kentia Palm	Low	Transplant
21	<i>Howea forsteriana</i>	Kentia Palm	Low	Transplant
22	<i>Howea forsteriana</i>	Kentia Palm	Low	Transplant
23	<i>Howea forsteriana</i>	Kentia Palm	Low	Transplant

2.5 Root Investigation Findings

An experienced contractor was engaged to carry out non-destructive excavation of an exploratory trench by hand and using an airspade. The trench was significantly constrained by the verandah, built on a concrete slab at grade to the west and the site boundary hob wall to the east. The trench measured, approximately 450mm wide and 500-600mm deep on the western side of the site boundary wall immediately adjacent to T13. Any substantial roots encountered (roots greater than 40mm Ø) were carefully exposed and traced to determine their direction of growth and likely tree of origin. A bench mark (BM) was established on the kerb at Park Lane to accurately record the location of exposed substantial roots.

We noted the following observations:

- There was evidence of roots on the western side of the T13 tree having previously been cut, possibly to accommodate footpath or services installation and or repairs.
- Trenching exposed a substantial concrete footing for the boundary hob brick wall at a depth of 300mm
- A copper water pipe was exposed at a depth of 300mm and ran along the face of the adjacent verandah on the western side of the trench.
- The first substantial root that was exposed at a distance of 4.7m from the BM, 70mm Ø, depth 340mm, growing through PVC pipe and perpendicular to boundary wall. The direction of growth, towards the boundary wall, indicated that the tree of origin was within the site. Given the direction of

growth, it is assumed this root was from the nearby *Sapium sebiferum* (Chinese Tallow Tree) T12 located in the north eastern corner of the south site.

- The second substantial root that was exposed at a distance of 5.1m from the BM, 160mm Ø, depth 200-300mm, growing perpendicular towards, then parallel along boundary wall to the south to a distance of 6.1m from the BM. The root then disappeared under the concrete footing of the boundary wall, to the east. The water pipe running along the face of the verandah (western side of the trench) passed beneath this root. This root although larger, showed similar surface texture to the first root encountered. The direction of growth, towards the boundary wall, indicates the tree of origin is within the site, again most likely the *Sapium sebiferum* (Chinese Tallow Tree) T12, located in the north eastern corner of the site.
- The only other minor roots that were encountered within the exploratory trench were those of a sapling *Celtis sinensis* (Chinese Hackberry) that was removed to facilitate the trenching.
- No roots from T13 *Grevillea robusta* (Silky Oak) CoS street tree, were encountered in the exploratory trench to a depth of 600mm on the western side of the site boundary wall.

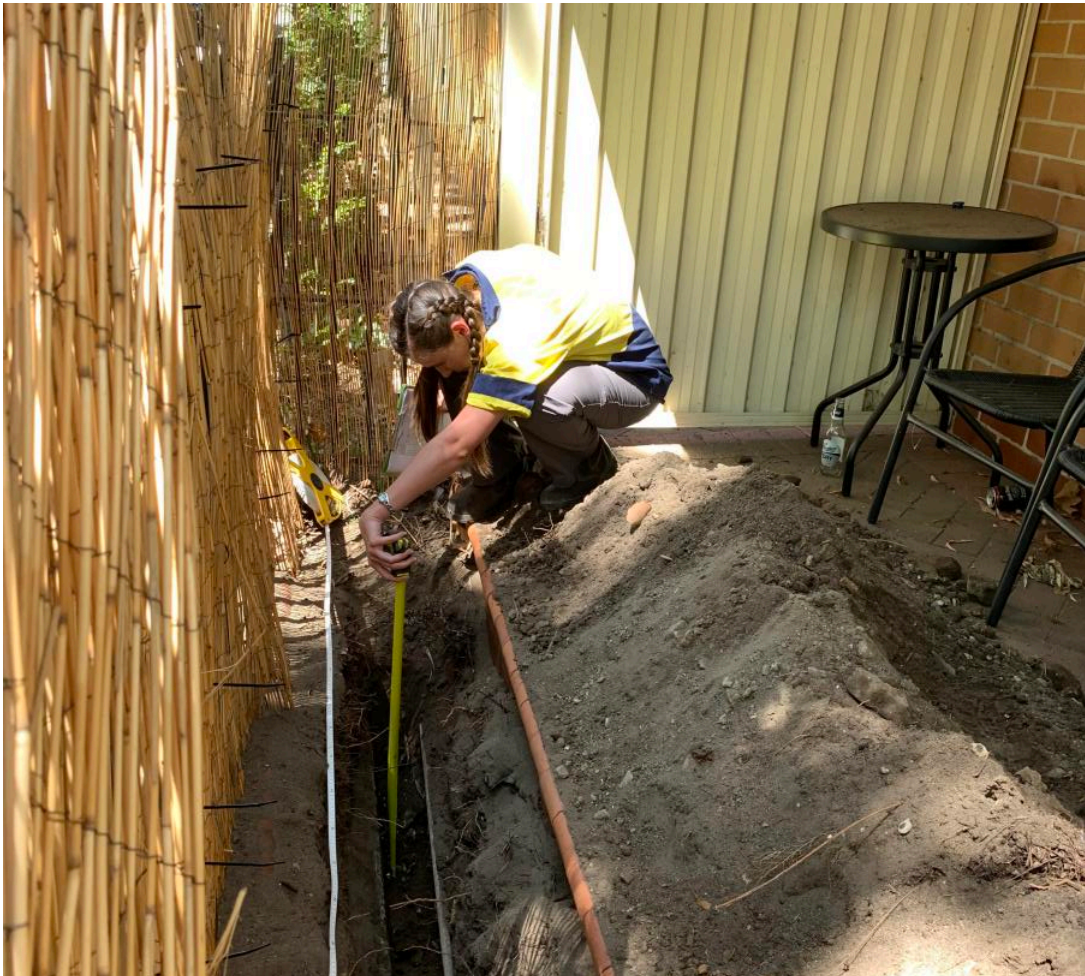


Figure 5 – Consulting arborist measuring the depth of the exploratory trench. (Photo Arterra 21.01.20)

Based on the above, it is our conclusion that no major roots from the street tree, (T13) *Grevillea robusta* (Silky Oak), remain or were encountered within the exploratory trench immediately inside the site boundary wall. The trench was excavated to a depth of 600mm for a distance of 4.5m along the boundary immediately adjacent to the subject tree. We therefore believe that excavation within the site can be undertaken for the proposed building with minimal impact to the tree. The required setback of the building has therefore been set to primarily limit the required pruning of the canopy that overhangs the site to acceptable levels. No root impacts are expected to this tree as part of the works.

2.6 Tree Biology and Tree Care Basics

Trees are dynamic living organisms. Trees can be very susceptible to damage, stress and declining rapidly if overly impacted by construction. Trees take decades to grow but can be injured and killed in a very short time frame. This is particularly due to the irreparable damage to the often shallow, extensive and unseen root systems. It is rarely possible to repair a stressed or damaged tree, after the damage has occurred. Proper

protection is the key to minimising construction related impacts. Severing of roots within the Structural Root Zone (SRZ) can also lead to potentially unsafe instability of the tree as a structure.

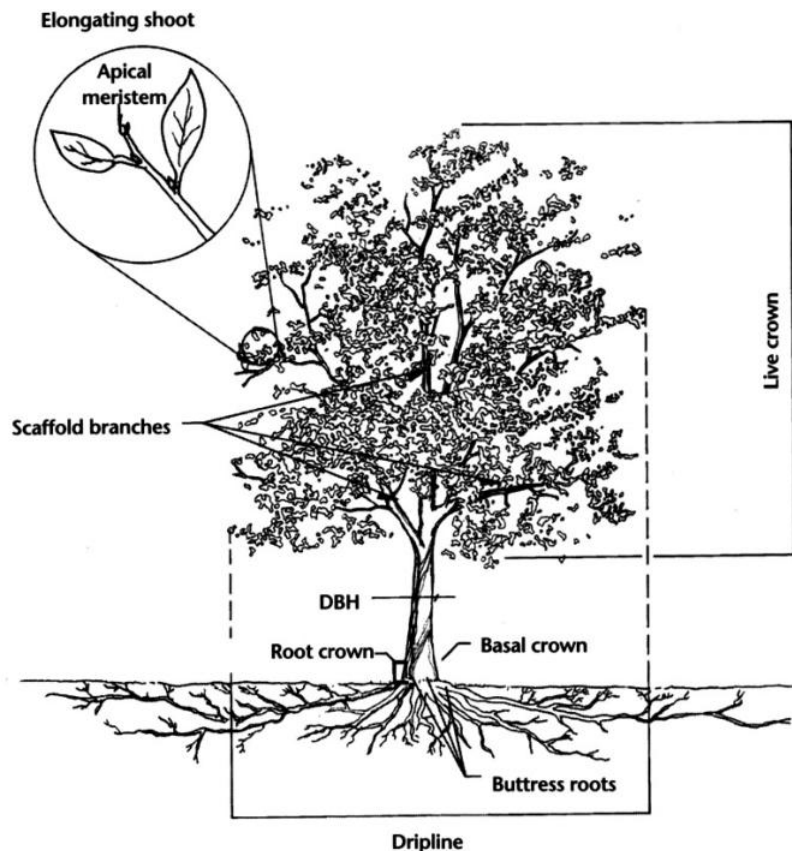


Figure 6 – Typical form and structure of a tree illustrating the typical form, location and extent of root growth (Source: Matheny and Clark, 1998)

Basic Tree Needs

As a living organism a tree remains alive by completing the following chemical reaction - Carbon Dioxide and water in combination with chlorophyll and light is converted to Glucose and Oxygen [$\text{CO}_2 + \text{H}_2\text{O} + \text{light} = \text{sugar (CH}_2\text{O [Glucose])} + \text{O}_2$]

The process ultimately leads to the plant cells 'respiring' and producing energy for survival, a natural requirement for all living cells. Anything that affects a plant's photosynthesis and then cellular respiration will affect the overall plant health. The limiting factors of photosynthesis and respiration will typically be the availability of oxygen, water and nutrients that make up the important chemical molecules and reactions.

Trees therefore have five basic requirements to survive and successfully grow:-

1. Oxygen (and particularly oxygen within the soil);
2. Water (a cellular necessity and primarily taken up by the tree roots);
3. Light & Sufficient Foliage (in order to photosynthesise and create the resources needed for cellular survival);
4. Soil (for physical anchorage and critical chemical nutrients) and
5. Physical Space (both above and below ground to grow).

Importantly, a minimum of 15% soil oxygen is required for active root growth and nutrient uptake. Less than 10% available soil oxygen starts to restrict root extension and growth and a minimum of 3% soil oxygen is required to just maintain root existence. Less than this will result in root death (Harris 1999).

One of the most insidious effects of construction on trees is often that of soil compaction or covering of root zones with impervious surfaces, as it:-

- Reduces infiltration rates of surface water;
- Reduces the availability of water to the roots as they can't naturally extract remaining moisture when soil becomes too dry;
- Reduces air to roots (roots cease to function properly and die without oxygen);

- Increased soil strength caused by compaction mean that roots need more energy to grow through it or can't even physically penetrate the soil;
- Roots are physically broken or crushed and there is increased potential for fungal and pathogen attack. (Harris 1999).

Tree Tolerance

Typically, older and larger trees are less tolerant of construction impacts. Different species also have different tolerance of injury and disturbance. Importantly it needs to be stressed, that a tree does not “heal” from injury as animals do. Typically, any injury made to a tree results in the tree expending considerable energy reserves to create new growth that “seals” and surrounds a wound and then attempting to compensate structurally and physically for any losses. Impacts to trees are therefore cumulative and a series of otherwise small and unrelated impacts can easily result in the death of a tree.

A tree that is already compromised or showing signs of stress is far less likely to tolerate construction impacts due to its lower levels of energy reserves and already weakened state. Therefore, a tree that is only in a fair condition or poor condition is less likely to tolerate construction impacts than a young tree in good or excellent condition.

Weakened or stressed trees are also far less able to combat the myriad of normal environmental stresses and pathogens that are naturally imposed against them such as drought, decay, fungi, bacteria and insect pests.

2.7 Tree Impact Assessment

The intention of this assessment is to clearly illustrate the trees to be retained and removed as part of the development. It is also to determine any incursions into the retained trees’ root zones and canopies by the proposed development and evaluate the likely impact of the proposed works on the trees. A detailed summary of the incursions and likely impacts of the proposed development on each tree is shown in Appendix 4.4 – Tree Impact Assessment Schedule.

- **23** trees are currently recorded and assessed on, or immediately adjacent to the two sites.
- **14** trees are located within the sites (with all but 1 small palm tree within the southern portion).
- **9** trees are located outside the site boundaries and are either adjoining street or park trees.
- **7** trees are palms trees that are in good condition and could potentially be transplanted and used within the site final landscaping.
- **6** trees are rated as ‘high’ retention value and should be targeted for protection and retention. All of these ‘high’ value trees are located outside the site.
- **11** trees are rated with a moderate retention value.
- **6** trees have a low retention value and should therefore not constrain the development outcomes.
- None of the trees are rated as very low retention value or with serious defects that warrant immediate attention.

The most significant trees relating to the site are the adjoining street and park trees. This includes T01 on Wentworth Park Road, T02-T05 along Mitchell Lane (within MJ Doherty Reserve), and T13-16 along Cowper Street. T13 is a very large *Grevillea robusta* (Silky Oak) while the other trees along Cowper Street are *Stenocarpus sinuatus* (Qld Firewheel Tree).

Of the **23** trees assessed:-

- **6** are recommended for removal due to being within the footprint of the proposed works;
- **7** palms are recommended to be considered for transplanting and use within the final site landscaping;
- **5** have no or minimal foreseeable impact from construction related activity;
- **5** have minor encroachments as defined under AS 4970;

The trees proposed for removal are not discussed further in this section. The potential tree impacts and potential mitigating actions are discussed further below.

Tree T01 - *Platanus x acerifolia* (London Plane)

This is the largest and most visually significant tree which is a street tree situated on the southern side of Wentworth Park Road, just north of the project site. The verge width is approx. 3.5m and the tree is located adjacent to the road kerb. This tree has been rated with a ‘High’ retention value. It has a relatively large and spreading canopy that extends over the northern portion of the site. Given the trees close proximity to the site, it is assumed that its root system extends well beyond the site boundary. There are some existing retaining walls, concrete stairs and raised garden beds in close proximity to the southern side of the tree, however, it is assumed that many of the tree roots may extend beyond and below these structures.

The proposed development is likely to result in an incursion from the pruning required to provide clearance to the tree for the construction of the upper levels of the building facing Wentworth Park Road. The proposed construction of the building has been set back to accommodate this tree. It has been calculated that the removal of roots to the southern side of the tree represents an incursion of approximately 7% of the nominal TPZ. According to AS4970-2009 this is considered a minor incursion and unlikely to adversely affect the condition of the tree in the longer-term. It is proposed that the existing structures between the proposed building and the tree will be carefully demolished and any roots existing below these structures will be retained and protected. It is the author's opinion that the proposed new structures to achieve access and landscaping in front of the proposed building can be built in a way to minimise the loss or damage of the existing roots.

Some canopy pruning will be required to the southern side of the tree to accommodate the new building and clearance for construction period scaffolding. This pruning is considered acceptable and is dealt with more specifically in **Section 3.2 - Canopy Pruning and Methodology**.



Figure 7 – T01 - A large and prominent *Platanus x acerifolia* (London Plane Tree) – Street tree adjacent to 2 Wentworth Park Road.

Tree T06 - *Corymbia maculata* (Spotted Gum)

This is a mature tree rated with Moderate retention value. It has a TPZ radius of 6.7m and is growing in very close proximity to the low retaining wall in the southwest corner of the site, adjacent to Mitchell Lane. The tree shows history of minor pruning for clearance to the existing building to the east.

The building and basement has been designed to retain this tree with a nominal incursion of 10%. The existing ground levels around the tree are proposed to be retained. A portion of the ground level terrace building structure does further encroach over the root zone, however this has been designed to sit above the existing

surface levels in an area that is already largely impacted by the pre-existing buildings (to be demolished). It is the author's opinion that this can be constructed with minimal impact to the tree if appropriate construction period measures are put in place and no excavation takes place in this area apart from supporting piles. The high branching nature of this tree means that the existing canopy and branches can be retained without the need for any pruning.



Figure 8 – T06 - A *Corymbia maculata* (Spotted Gum) on the site in the south-west corner.

T13 – *Grevillea robusta* (Silky Oak). This is a very large street tree located on the eastern side of the proposed development. It is 18m tall with a canopy spread of 14m. It has a significant main branch crossing the eastern boundary at approximately 9.0m in height above the footpath level. This tree also forms part of the heritage listed group of street trees along Cowper Street, which include *Grevillea robusta* (Silky Oak), *Flindersia australis* (Australian Teak) and *Castanospermum australe* (Moreton Bay Chestnut) species. This results in this tree having greater significance in the landscape and should therefore be retained as part of the development. Though the tree is heritage listed, due to the tree being a less than desirable and somewhat invasive species and an older specimen with some defects it has been given only a 'Moderate' retention value.

Given the size and significance of the tree however, Arterra have undertaken further non-destructive root investigations adjacent to the tree, immediately inside the boundary of the site. This was an attempt to expose and map any existing roots from this street tree that may have crossed the boundary into the site and therefore dictated works and setbacks around this tree.

A trench was excavated using hand tools and an 'airspace' to a depth of 600mm below the existing ground level. No significant or structural roots from this tree were observed within this exploratory trench. If roots were to be found it is reasonable that they should have been visible within this depth. Given no major structural roots were found it is likely that the roots from this tree have previously been severed as part of the 1970-80s

development of the site. In Arterra's opinion, basement excavations for the proposed development, as long as they are within the site boundaries, are unlikely to significantly impact this trees health or stability.

Though basement excavations may not cause significant impact to the tree or restrict development at the ground level, it is still important to consider the extent of the proposed development above ground with respect to the existing canopy which overhangs the site to the west. This has constrained the building setback and extent of development on the eastern side of the site. Major pruning works that would remove substantial foliage or branches and make the tree lop-sided would not be supported by the Council.



Figure 9 – View from Cowper Street looking at 'High' retention value tree – T13 Grevillea robusta with proposed development site beyond to the right. (Photo: Arterra 05/11/19)

T02, T03, T04 & T05 – *Platanus x acerifolia* (London Plane). This is a row of four very visually and environmentally significant trees. These trees are situated to the west of the site, within the adjoining MJ Doherty Reserve and adjoining Mitchell Lane. These trees have been rated with a 'High' retention value. They have relatively large spreading canopies that extend over Mitchell Lane and are within close proximity to the site. These 'High' value trees provide good landscape amenity and serve to screen and soften any proposed development from the adjoining reserve and will provide a level of 'instant landscape' to any proposed building setting. Being large and deciduous trees they also provide excellent summer shade together with winter sun to the reserve and the development site. It is our assessment that these trees will have minimal to no impact from the proposed development.



Figure 10 – View to the east from MJ Doherty Reserve looking at ‘High’ retention value trees - T02, T03, T04 & T05 *Platanus x acerifolia* with proposed development site beyond. (Photo: Arterra 23/10/19)

The other remaining ‘High’ value tree is a street tree T14 *Stenocarpus sinuatus* (Queensland Firewheel Tree). This tree ties in with two others, T15 & T16 of the same species which are of ‘Moderate’ retention value. The moderate value trees are smaller more recently planted specimens. This species are nominated as the preferred tree species in the current CoS’s Street Tree Master Plan for Cowper Street. They should be retained and protected.



Figure 11 – View from Cowper Street looking at ‘High’ retention value tree – T14 *Stenocarpus sinuatus* with proposed development site beyond. (Photo: Arterra 05/11/19)

2.8 Potential Tree Related Impacts to be Managed During Construction

The main potential impacts from the proposed construction activity can be summarised as tree damage and 'reduced life expectancy' caused by:-

- Root loss and disturbance due to excavation;
- Compaction of the root zone from storage and stockpiling of materials;
- Contamination of the soil from; the preparation of chemicals, wash down/ cleaning of equipment, refuelling of vehicles and dumping of waste;
- Compaction of the root zone from haul roads and the parking of vehicles/ plant equipment;
- Root disturbance from cut and fill and soil level changes;
- Physical damage to tree trunks and branches from passing machinery;
- Damage to tree roots from landscaping and pedestrian pathway construction.

The following Section provides recommendations and proposed measures that aim to minimise and avoid these impacts as much as realistically possible.

3.0 TREE MANAGEMENT RECOMMENDATIONS

3.1 Potential Amendments to Site Layout and Design

The landscaping and proposed building layout have been developed in consultation with the Client and the Architects. Arterra, as the consulting arborists, have aimed to minimise the impact on the existing trees to be retained and the design has been modified to this effect wherever possible. The trees noted for removal, as well as those to be retained, have been given careful consideration and recommendation for removal has not been given lightly.

As the current design has been developed in consultation with the consulting arborist, appropriate changes have been implemented throughout the design development process to accommodate the existing trees wherever possible. On this basis there are no recommendations to alter the design further at this time.

3.2 Canopy Pruning and Methodology

3.2.1 Extent of Pruning

Two of the adjoining street trees are required to be pruned to facilitate the proposed development. The aim is to provide additional information on the required canopy pruning needed for T01 (*Platanus x acerifolia*) and T13 (*Grevillea robusta*) to facilitate the construction of the new development and to provide a suitable canopy pruning methodology. Most importantly it is intended to clearly identify the branches that are to be pruned so that the Development Manager and their chosen Contractors can take a proactive approach to the management of this tree to be retained and put in place appropriate measures to protect the tree during construction.

Specifically, this section aims to:-

- Clearly define what is to be pruned and to what extent.
- Ensure the qualifications of personnel undertaking pruning works.
- Define the required oversight and supervision of the pruning.
- Define the work standards that are expected and to be applied.
- Outline the minimum standards for machinery and pedestrian access and safety protocols to be applied.

As shown in T-03 Canopy Pruning Plan (Appendix 4.3) the proposed line of the buildings have been set back from the boundaries to facilitate retention of the large adjoining street trees. To facilitate the construction of the building, a scaffold will need to be erected around its perimeter. It is assumed that a 2.0m wide frame will be used. These constraints still result in some impacts to the existing canopy and will result in the removal of some branches and foliage.

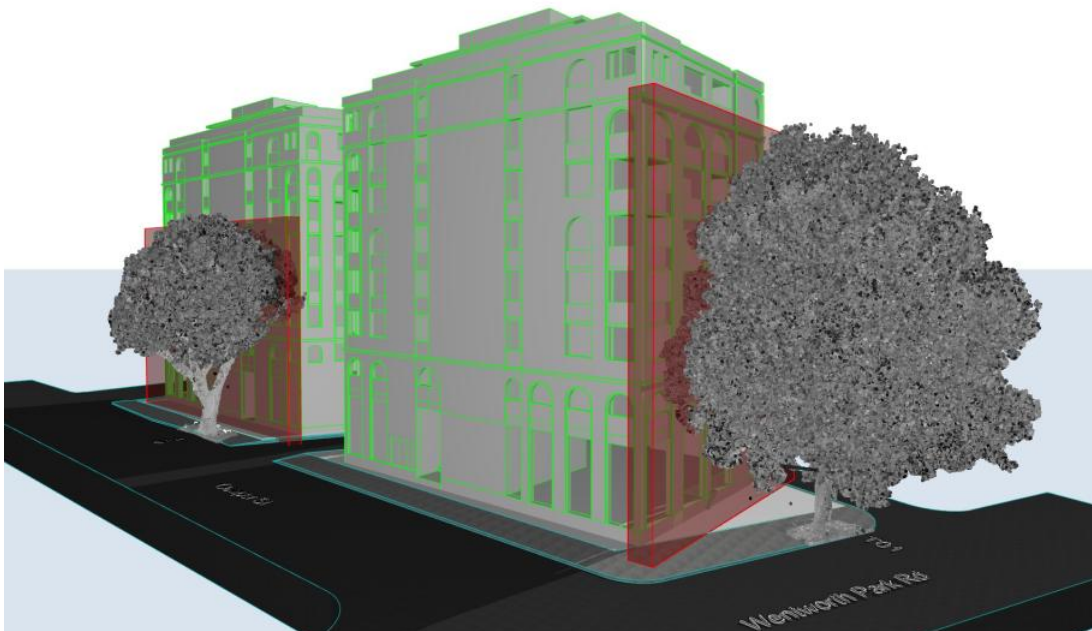


Figure 12 – View of 3D computer model of building and point cloud data obtained for trees – T01 to the right and T13 on Cowper Street to the left. Red zone indicates scaffold cut line. (Image Source: Arterra)

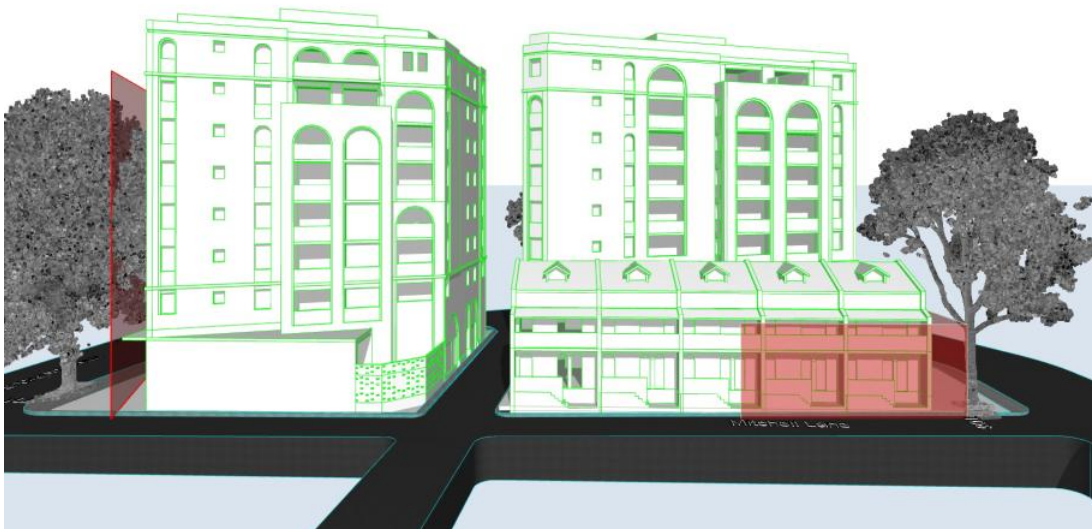


Figure 13 – View of 3D computer model of building and point cloud data obtained for trees – T01 to the left and T06 on the site to the right. Red zone indicates scaffold cut line. Note that the habit and foliage of T06 are well clear of terraces and should not require any pruning. (Image Source: Arterra)



Figure 14 – View of 3D computer model of building and data obtained for trees stripped down to the major branches for T06. Red line/zone indicates scaffold cut line. Note that the majority of main branches are well clear of proposed building and should not require any pruning. (Image Source: Arterra)

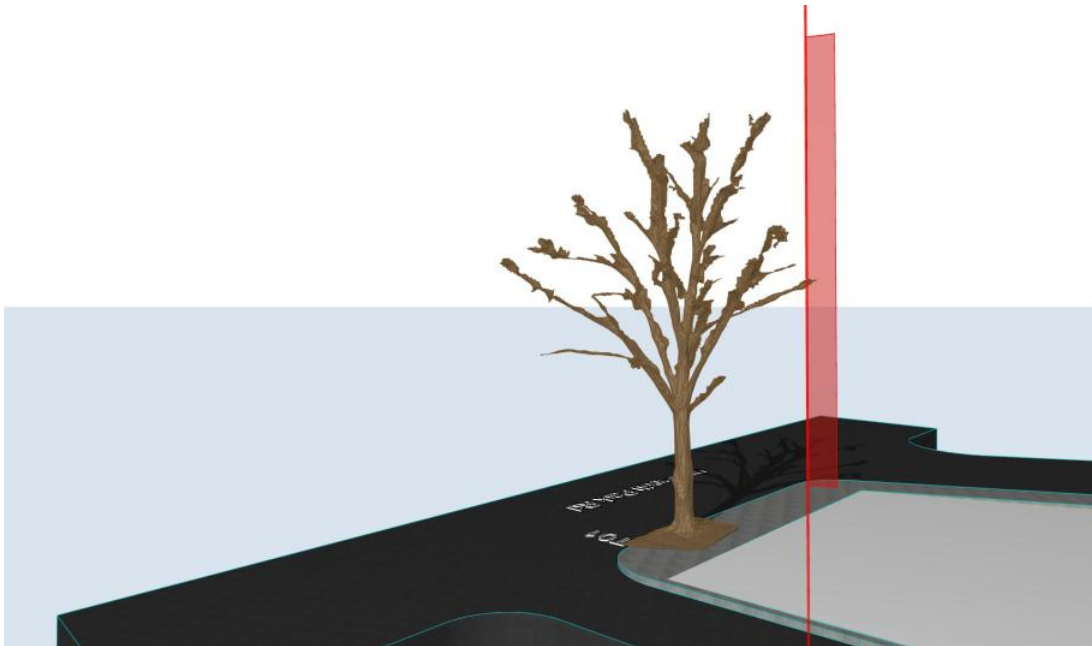


Figure 15 – View of 3D computer model of building and data obtained for trees stripped down to the major branches for T01. Red line/zone indicates scaffold cut line. Note that the majority of main branches are well clear and should not require any major pruning. (Image Source: Arterra)

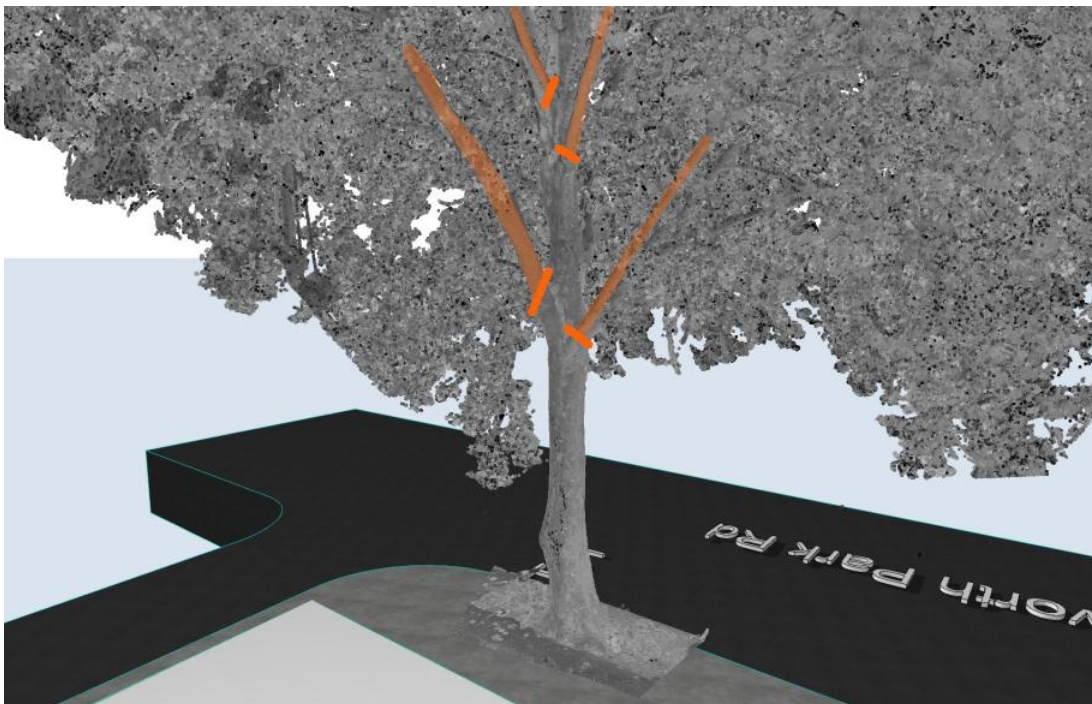


Figure 16 – View of 3D computer model of T01 point cloud data obtained for the tree. Viewed from inside site looking north. Diagram indicates the proposed branches and proposed line of pruning to be undertaken to achieve appropriate clearance for building and scaffold. (Image Source: Arterra)

Table 2 – Schedule of Proposed Pruning T01

Branch Qty and Size at Cut	Comment / Notes
1 x 150mm	Lowest branch to southern side of tree taken back to trunk
1 x 100mm	Mid canopy to southern side of tree taken back to trunk
1 x 100mm	To south-eastern side of tree taken back to trunk
1 x 75mm	Lowest branch to south-eastern side of tree taken back to trunk
3 x <50mm	Various small branchlets in upper canopy taken back to nearest appropriate junction

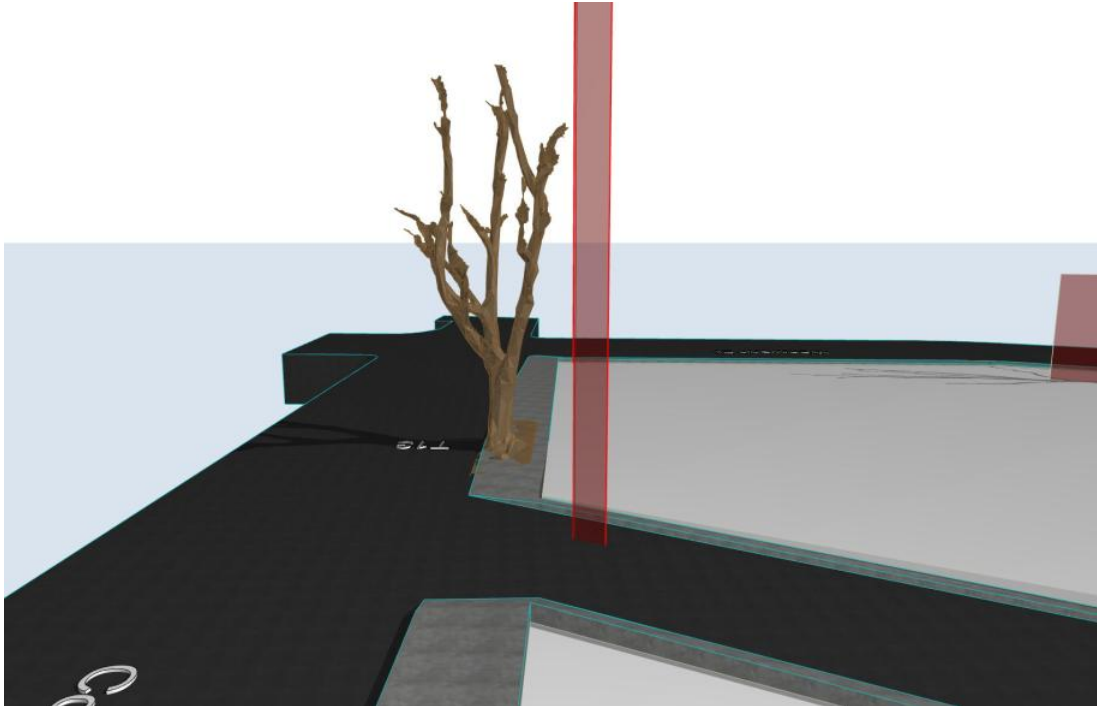


Figure 17 – View of 3D computer model of data obtained for trees stripped down to the major branches for T13. Red line/zone indicates scaffold cut line. Note that all main branches are well clear and should not require any major pruning. (Image Source: Arterra)

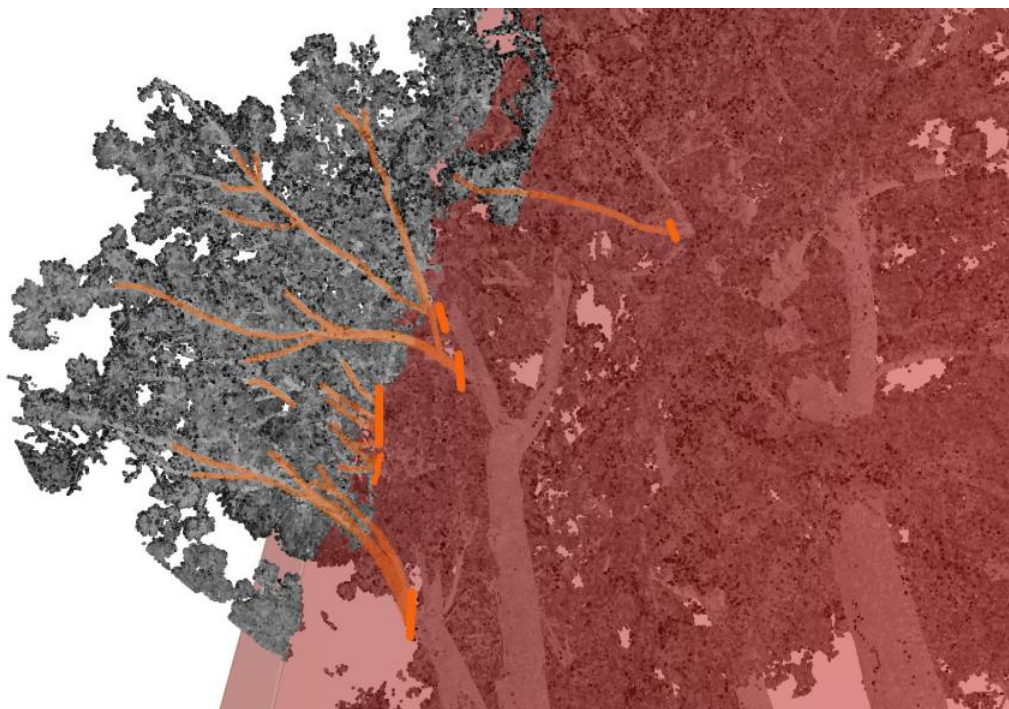


Figure 18 – View of 3D computer model of T13 point cloud data obtained for the tree. Viewed from inside site looking north-east. Diagram indicates the proposed branches and proposed line of pruning to be undertaken to achieve appropriate clearance for building and scaffold. (Image Source: Arterra)

Table 3 – Schedule of Proposed Pruning T13

Branch Qty and Size at Cut	Comment / Notes
1 x 75mm	Mid canopy to western side of tree taken back to nearest suitable main branch junction
8 x 50mm	Mid canopy to western side of tree taken back to nearest suitable main branch junction

3.2.2 Pruning Expertise

A suitably qualified Tree Contractor/Utility Arborist shall be a member of Arboriculture Australia or equivalent body. They are to be employed, instructed and directly supervised in their activities by an Arborist with a minimum AQF level 4 qualification in arboriculture.

To ensure the work is undertaken using the methods envisaged during the design and tree assessment phases of the project, the pruning work is to be reviewed and monitored in the field by the designated Project Consulting Arborist, using this document and the accompanying plans and above figures as a guide. The intention is to limit the pruning of the existing trees, while still allowing the appropriate provisions for construction access and future regrowth of the trees and foliage.

The Head Contractor/Development Manager is to submit to the Project Consulting Arborist the name(s), relevant qualifications, trade certificates, first aid and memberships, licenses and experience of the chosen utility arborist personnel. Where possible, and reasonable, the same Utility Arborist shall be used for all the tree pruning work on the site.

3.2.3 Canopy Pruning – Generally & Standards

The Tree Contractor shall prune only the selected branches of the protected tree and only as directed by the Project Consulting Arborist. Pruning is only to be undertaken by a suitably experienced and qualified Utility Arborist, as noted above. Work is to be in strict accordance with to AS4373 Pruning of Amenity Trees. Do not treat the resulting pruning wounds.

The Tree Contractor shall minimise the size and number of wounds resulting from all pruning. Ensure remaining canopy is balanced with appropriate weight and crown distribution. Use only clean, sharp pruning implements for all pruning work, ensuring that cuts are made without damage, tearing or bruising of remaining vascular tissue.

Deadwooding

Remove all dead or near dead branches >50mm diameter, where reasonable and feasible to do so during the planned pruning work.

Selective and Reduction Pruning

Remove the identified branches and branchlets for the necessary building or piling rig clearance requirements. These should be removed to a suitable internal lateral branch at least 1/3 the diameter of the branch removed or to the branch collar at the nearest stem or trunk. Also remove any broken, damaged and defective branches as required. Remove any nearby crossing and rubbing branches and branches with included bark at their junction to ensure proper form and branching habit as required, but only if appropriate.

3.2.4 Pruning Access, Traffic and Pedestrian Management

Typically, all pruning work shall be undertaken from within the proposed construction site. Access to the foliage shall be from elevated work platforms with suitable reach to access the required canopy.

Suitable pedestrian access alternatives shall be provided to all the adjacent street verges during the course of tree work. Where tree work will result in a danger to the public, suitable signage and barricades and 'spotter' personnel shall be placed to ensure the work is undertaken safely, while pruning is occurring overhead.

The Contractor shall minimise the effect of the works on the normal access to nearby properties and streets and minimise the disruption to the normal commercial or residential activities of those properties and streets. The Tree Contractor shall comply with all directions, in this regard, provided by the Head Contractor/ Development Manager.

3.2.5 Removed Tree Material Disposal

All branches and foliage that is pruned is to be chipped, and removed from the site. All chipping activities shall be undertaken from within the site boundaries.

3.2.6 Monitoring and Oversight

Pruning has a direct impact on the health, structure and viability of a tree. All pruning of live tissue results in a wound to the tree, which the tree has to attempt to seal and compartmentalise. Incorrect pruning techniques can lead to increased risk of decay and disease within the tree, much the same as a wound in animals can lead to disease and infection. Pruning of the canopy also has the consequence of removing valuable foliage, which in turn removes an essential source of energy production from the tree. The tree will then also spend considerable reserves of energy in trying to regrow the losses of the foliage. Branches and trunks are also important transport and storage tissues within the tree. To limit the impacts of the required pruning:

- Only 'selective pruning' is to be undertaken - selected branches shall be as per the above listings and as identified for removal in the field by the Project Consulting Arborist and the appointed Utility

Arborist. Work shall be done incrementally until the appropriate building and scaffold clearance is achieved.

- Pruning work shall be undertaken from 'the site' side of the trees using appropriately skilled Utility Arborists, typically working from suitably sized Elevated Work Platforms.
- All pruning is to follow AS4373-2007 Pruning of Amenity Trees.

3.3 Key Tree Management Recommendations to Reduce Tree Impacts

The following recommendations are made to potentially reduce the negative construction impacts on the trees.

- Ensure that an appropriately qualified Arborist is on site and supervises all major demolition work within the identified TPA areas.
- Appropriately fence all TPAs outside of the incursion for the duration of all major site construction work. See Appendix 4.2 TP-02 'Tree Protection & Removal Plan' for locations
- Carefully control and fence access to and from the construction area so that movement does not occur through any TPA other than the building incursion.
- Ensure all the above and below ground services are excluded from running through any TPAs beyond the already noted incursions.
- Minimise the re-grading of the ground surface within the TPAs, beyond the noted building incursion, to meet and match proposed pathways and building levels. Where it is required, limit it to a maximum depth of 300mm above existing ground levels and ensure it is only quality sandy manufactured organic garden mix.
- Mulching of the entire TPA of T06, beyond the noted building incursion. This will aid tree health with moisture retention, minimise compaction, remove competition from weeds, and improve soil condition within the TPAs.
- Avoid digging into existing root zones for the installation of the proposed landscaping around the trees and installation sizes of new plants to be 5L or less to ensure that excavations are less than 200mm in depth. Build up soil levels when planting to a maximum of 200mm to enable the planting to occur without disturbing roots.
- Do not allow storage or stockpiling of any materials or site sheds within established TPAs unless that it can be demonstrated that this will not impact on the tree retention and is approved in writing by the Consulting Arborist.

3.4 Proposed Tree Protection & Construction Activity Sequencing

The following sequence of activities should be followed for this project: -

1. A Tree Protection Specification & Plan be prepared and issued as part of the construction contract prior to any construction work.
2. Project Consulting Arborist, Landscape Architect, Civil and Structural Engineers, Client and Contractor Site Foreman are to meet prior to beginning any work on the site to discuss and review all work procedures, construction access routes, stockpiling and tree protection measures (ie: fence types and locations, access, craneage points, piling methods etc.).
3. Contractor's to discuss locations and type of any sediment and erosion controls (if any) and install them with minimal tree impact when within or passing through the TPA's.
4. Existing buildings, pathways, fences, driveways, furniture and shrubs are to be carefully removed from within the TPA's.
5. Existing surrounding trees are to be removed. Stumps are to be ground to avoid the use of excavators and the like from grubbing out stumps, which may lead to damage of any intertwined roots.
6. Designated TPA for T06 is to be mulched with 75mm of recycled hardwood woodchip mulch to improve soil conditions, limit compaction and root disturbance around tree and remain in place until future landscaping.
7. Trunk protection to be placed on all trees to be retained as per T-02.
8. The Construction Phase TPA's is to be defined and fenced off with a 1.8m high metal or plywood temporary fence prior to any further work within the vicinity of the trees. Any required rumble boards installed to protect TPZ areas where access is required (none expected at this time).
9. Install temporary irrigation system to TPA of T06.
10. A utility Arborist is to undertake selective pruning of canopy or branches to facilitate construction of the building and the use of any large scale piling equipment without accidental damage to the tree canopy. Pruning to be done in accordance with AS4373 - Pruning of Amenity Trees and performed by staff with minimum AQF 3 qualification.
11. Plywood is to be placed under any scaffolds or pedestrian works paths when running through TPA's
12. Building works to be completed (external).
13. Contractor to remove the TPZ fencing and then install final pathways and landscaping within the TPA under the trees, only after major construction of the building exterior is completed.

3.5 Demolition Work Near Trees or within TPAs

Demolition of paths and other structures required within a TPA shall be done with small tracked equipment or by hand, with care to limit damage and disturbance of the root zone. All such work within TPA's shall be monitored, inspected and overseen by a qualified Project Consulting Arborist.

3.6 Tree Protection Fencing & Definition of TPAs

Establish the clearly defined tree protection areas as indicated in Appendix 4.2 - "T-02 Tree Protection and Removal Plan". Install a 1.8m high temporary fence with either plywood hoarding or temporary steel mesh or chain wire fencing with adequate lateral bracing. Fencing shall comply with the requirements of AS 4687-2007 Temporary fencing and hoardings. These areas around the trees shall be delineated as a "Tree Protection Zone" during the remaining construction process, via appropriate weatherproof signage. Access will typically be excluded from these zones and the levels will be left largely at the existing levels with the exception of the installation of the 75mm of mulch. No stockpiling, excavation, trenching, re-fuelling or material storage should be allowed in this area.

3.7 Ground Protection within TPAs

Vehicular movement and access shall typically not be required or approved through the TPAs. If it is necessary and it is proposed to create any access or haul road, or similar, within the TPZ of a retained tree, the Contractor shall install rumble strips / boards over the TPZ ground surface. No excavation shall be allowed. Contractor shall first place a suitable permeable geotextile to the extent required and then a 100mm thick layer of wood chip mulch or coarse no-fines gravel over the extent to be covered with the rumble strip / boards. Then place hardwood boards (minimum 3600 x 200 x 75mm) on their flat edge, side by side, with a 30 - 50mm gap to form a rumble strip. These boards are to be held together with three galvanised metal bracing straps nailed to each board. The two outer straps are to be approximately 200mm in from the ends of the boards. The third strap is to be along the centre line of the boards.



Figure 19 – Example of acceptable Tree Protection Area ground protection

3.8 Trunk and Lower Branch Protection

A trunk barrier is to be erected around the circumference of the tree trunk and trunk flare and root buttress. This barrier will consist of a double layer of suitable 'used' artificial grass matting, carpet or carpet underfelt placed around the trunk. A layer of battens is to be placed over the underfelt. The battens are to have a maximum spacing of 50-100mm. The height of the battens is to be 2 metres or to the height of the first branches. Lower large branches may require the same protection if they are likely to be damaged by passing vehicles or equipment. Secure in place with galvanised steel bracing straps. Do not nail into or otherwise injure the trunk or bark. Battens may be made from any suitable waste timber of similar sizes and depths. All sharp or protruding edges are to be properly covered with tape or similar padding.



Figure 20 – Example of acceptable Trunk Protection batten installation

3.9 Provision of Temporary Irrigation

A temporary and automated (battery powered timer is sufficient) watering system to be placed within the TPA of T06 to maintain adequate water to the retained trees and help maintain their healthy condition. This can be a surface mounted 'residential-style' soaker hose and/or surface sprinkler systems. It is to be surface visible and spray delivered so that its operation can be easily visible and verified. It should be on a designated supply line, separate from other construction related water supplies to minimise its likelihood of being disconnected.

Typically, during spring and summer months it should be set to run for a minimum of 30 minutes every day, in the early morning. During, autumn and winter months it should be set to run for 1 hour once every week. The operation can be suspended temporarily in periods of extensive and prolonged rain.

The system is to remain in place for the duration of construction, or until the project consulting arborist approves it's removal. It may be removed to allow final landscape treatments to proceed. If accidentally disturbed or damaged by construction activities, it is to be reinstated as soon as practicable.

3.10 Final Landscaping within TPAs

Once final levels are set by the finished structural elements. The final trimming and landscaping shall be judiciously undertaken. The final pedestrian pavements shall be installed without undue excavation or compaction to the soil and all soft landscaping within the tree protection zone will be installed with care to avoid root disturbance via irrigation trenching, lighting installation and the planting of larger plants. The installation of 100-200mm of new garden mix topsoil over the pre-existing soil will provide a suitable medium in which to plant new plants without damage to existing tree roots. Permanent irrigation (if used) shall be installed as spray heads located outside of TPZs and spraying inwards. All other services such as electrical services shall also be designed and installed to avoid any excavation or trenching around the trees.

3.11 Final Building and Pedestrian Clearance Pruning

Once the final levels and finishes are in place the Project Consulting Arborist shall supervise any selective pruning of any lower peripheral branches to retained trees to achieve any clearances for final pedestrian access. This shall be minimised as much as possible. It is anticipated that the final pruning of any of the retained trees will be less than 2% of the remaining existing canopy and will not have any serious impact to the trees health or habit.

The branches of the tree shall only be pruned as specifically needed and directed by the Project Consulting Arborist. Work is to be in strictly accordance with to AS4373 - Pruning of Amenity Trees. Do not treat wounds. Only clean, sharp pruning implements shall be used for all pruning work, ensuring that cuts are made without damage, tearing or bruising of the vascular tissue.

3.12 Other Tree Protection Measures to be Implemented

The following is a summary of the main measures that will be required during construction. These should be adopted for the Construction Contract and conditioned by Council.

Controlled Construction Access & Parking

Construction access points and stockpiling and storage areas shall be clearly identified and fenced where appropriate. Uncontrolled access points and parking of vehicles outside of designated areas is to be avoided. If temporary access is required through a tree protection zone, ground protection shall be employed to limit soil compaction and root damage and disturbance.

Clearing and Removal of Trees to be Removed

Removal and clearing of existing trees should be done by qualified arboricultural staff with care not to impact or damage other surrounding trees throughout the process. Existing stumps should be grubbed out or ground in a controlled fashion to remove wood that may decay and promote unwanted pathogens.

Communication - Tool Box Meetings and Construction Inductions

All contractors and subcontractors shall be inducted prior to working on the site. All inductions shall include description and identification of the Tree Protection Zones and the restriction on work and activities with regard to trees. The site foreman shall ensure that all new staff and contractors are appropriately inducted and that brief "tool box" meetings are conducted regularly to ensure Tree Protection is maintained at the forefront of all construction workers minds.

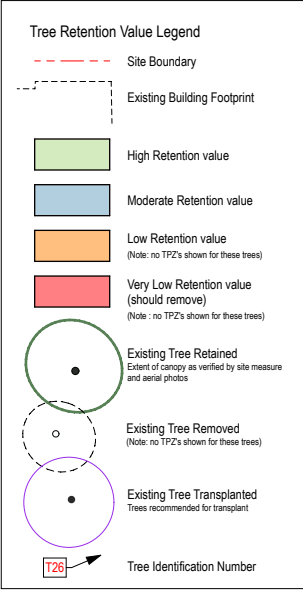
3.13 References

- Chapman, G.A and Murphy, C.L 1989, *Soil landscapes of the Sydney 1:100 000 Sheet Report*, Soil Conservation Service of NSW, Sydney, NSW.
- Harris, R.W, Clark, J.R & Matheny, Nelda P, 1999, *Arboriculture: Integrated management of landscape trees, shrubs and vines*. 3rd Ed. Prentice Hall. New Jersey, US
- Matheny, Nelda P and Clark J.R, 1998, *Trees and development - a technical guide to preservation of trees during land development*, International Society of Arboriculture, Illinois, US.
- Roberts, J. Jackson, N. and Smith, M. 2006. *Tree roots in the built environment. No.8* Research for Amenity Trees, Dept. for Communities and Local Government, London.
- Standards Australia, 2007, *AS 4373-2007 Pruning of amenity trees*. Standards Australia, Sydney.
- Standards Australia, 2009, *AS 4970-2009 Protection of Trees on Development Sites*. Standards Australia, Sydney.
- Standards Australia, 2007, *AS 4687-2007 Temporary fencing and hoardings*. Standards Australia, Sydney.

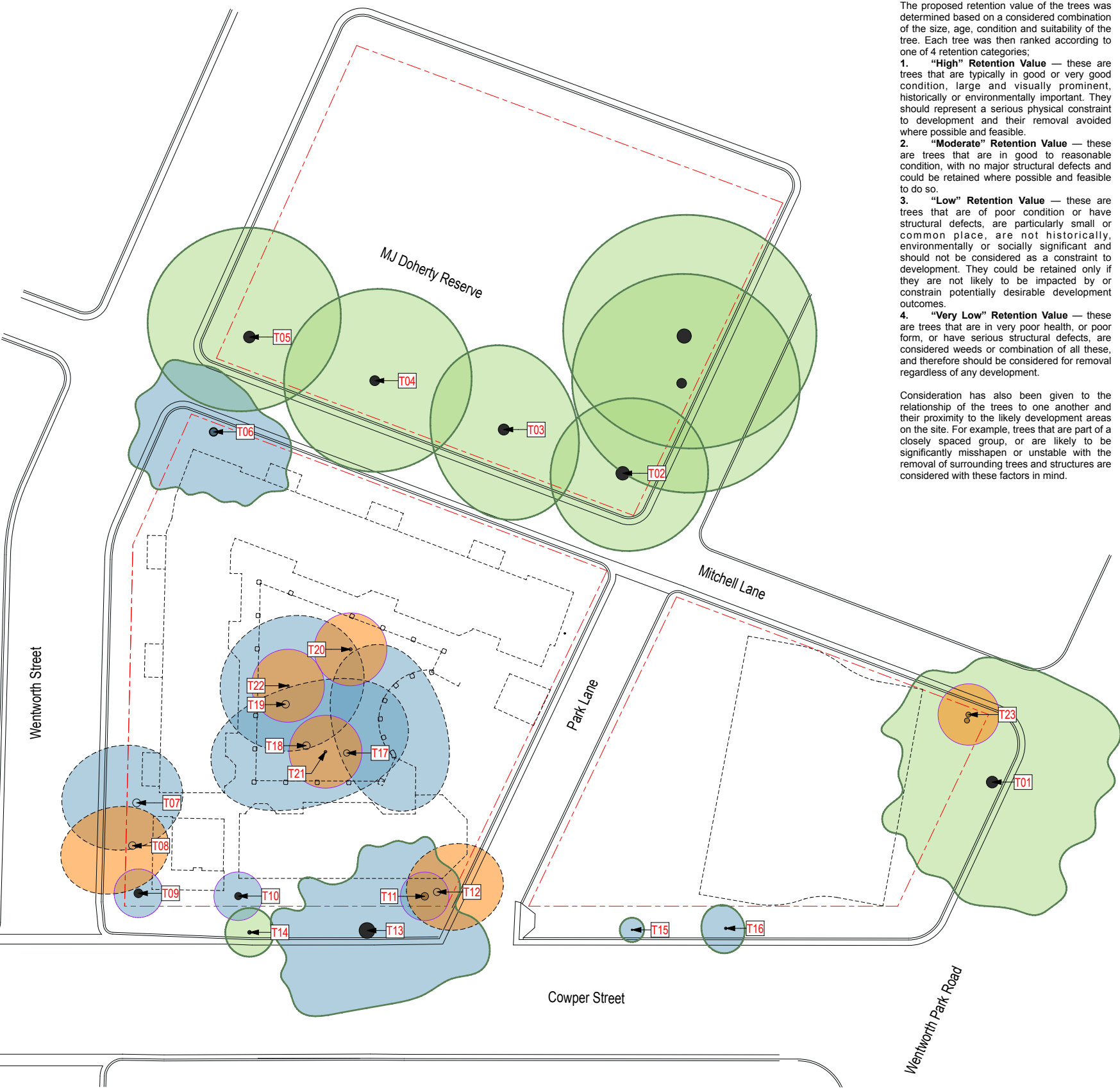
- End of report.

4.0 APPENDICES

4.1 TP-01 Tree Retention Value Plan



NOTE
Refer to the accompanying Arboricultural Preliminary Tree Report for full description of trees, measurements and methods used to assess the trees.



TREE RETENTION VALUE NOTES

The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree. Each tree was then ranked according to one of 4 retention categories:

- "High" Retention Value** — these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They should represent a serious physical constraint to development and their removal avoided where possible and feasible.
- "Moderate" Retention Value** — these are trees that are in good to reasonable condition, with no major structural defects and could be retained where possible and feasible to do so.
- "Low" Retention Value** — these are trees that are of poor condition or have structural defects, are particularly small or common place, are not historically, environmentally or socially significant and should not be considered as a constraint to development. They could be retained only if they are not likely to be impacted by or constrain potentially desirable development outcomes.
- "Very Low" Retention Value** — these are trees that are in very poor health, or poor form, or have serious structural defects, are considered weeds or combination of all these, and therefore should be considered for removal regardless of any development.

Consideration has also been given to the relationship of the trees to one another and their proximity to the likely development areas on the site. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees and structures are considered with these factors in mind.

31 Cowper St & 2A-2D Wentworth Park Rd, Glebe - Tree Assessment Schedule

Tree ID	Tree Species	Common Name	Trunk Diameter Breast Height (m)	Trunk Diameter at base (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Retention Value	Tree Management Recommendation
1	<i>Platanus x acerifolia</i>	London Plane	0.78	0.92	9.36	3.20	High	Retain and Protect
2	<i>Platanus x acerifolia</i>	London Plane	0.73	1.07	8.76	3.40	High	Retain and Protect
3	<i>Platanus x acerifolia</i>	London Plane	0.66	0.87	7.92	3.12	High	Retain and Protect
4	<i>Platanus x acerifolia</i>	London Plane	0.76	0.78	9.12	2.98	High	Retain and Protect
5	<i>Platanus x acerifolia</i>	London Plane	0.86	0.92	10.32	3.20	High	Retain and Protect
6	<i>Corymbia maculata</i>	Spotted Gum	0.56	0.67	6.72	2.80	Moderate	Retain and Protect
7	<i>Corymbia maculata</i>	Spotted Gum	0.52	0.65	6.24	2.76	Moderate	Remove
8	<i>Acacia elata</i>	Mountain Cedar Wattle	0.52	0.63	6.24	2.73	Low	Remove
9	<i>Washingtonia robusta</i>	Washington Palm	0.52	0.73	3.00	2.90	Moderate	Transplant
10	<i>Washingtonia robusta</i>	Washington Palm	0.46	0.60	3.00	2.67	Moderate	Transplant
11	<i>Washingtonia robusta</i>	Washington Palm	0.41	0.62	3.00	2.71	Moderate	Transplant
12	<i>Sapium sebiferum</i>	Chinese Tallow Tree	0.46	0.60	5.52	2.67	Low	Remove
13	<i>Grevillea robusta</i>	Silky Oak	1.02	1.25	12.24	3.63	Moderate	Retain and Protect
14	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.22	0.26	2.64	1.88	High	Retain and Protect
15	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.06	0.09	2.00	1.20	Moderate	Retain and Protect
16	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.15	0.17	2.00	1.57	Moderate	Retain and Protect
17	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.44	0.52	5.28	2.51	Moderate	Remove
18	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.50	0.63	6.00	2.73	Moderate	Remove
19	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.51	0.62	6.12	2.71	Moderate	Remove
20	<i>Howea forsteriana</i>	Kentia Palm	0.15	0.26	2.00	0.80	Low	Transplant
21	<i>Howea forsteriana</i>	Kentia Palm	0.12	0.22	2.00	0.80	Low	Transplant
22	<i>Howea forsteriana</i>	Kentia Palm	0.14	0.19	2.00	0.80	Low	Transplant
23	<i>Howea forsteriana</i>	Kentia Palm	0.20	0.42	2.40	0.80	Low	Transplant



202

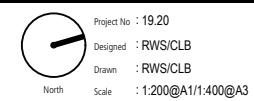


ARTERRA DESIGN PTY LTD ABN 40 069 552 610
SUITE 602 / 51 RAWSON STREET, EPPING, NSW 2121
P 02 9957 2466 F 02 9957 3977 W ARTERRA.COM.AU

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	13/5/20

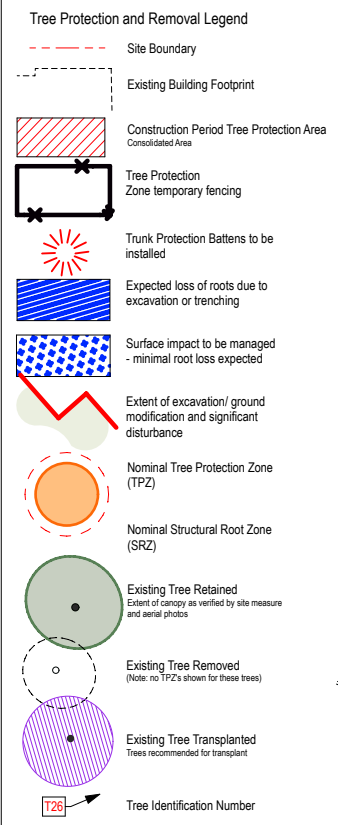
PROJECT & CLIENT
Glebe Mid-Rise, Cowper Street Glebe

NSW DPIE-Land and Housing Corporation
DRAWING TITLE
Tree Retention Value Plan



DRAWING NUMBER
T-01

4.2 TP-02 Tree Protection and Removal Plan



NOTE
Refer to the accompanying Arboricultural Preliminary Tree Report for full description of trees, measurements and methods used to assess the trees.

31 Cowper St & 2A-2D Wentworth Park Rd, Glebe - Tree Assessment Schedule

Tree ID	Tree Species	Common Name	Trunk Diameter Breast Height (m)	Trunk Diameter at base (m)	Nominal TPZ radius (m) (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Retention Value	Tree Management Recommendation
1	<i>Platanus x acerifolia</i>	London Plane	0.78	0.92	9.36	3.20	High	Retain and Protect
2	<i>Platanus x acerifolia</i>	London Plane	0.73	1.07	8.76	3.40	High	Retain and Protect
3	<i>Platanus x acerifolia</i>	London Plane	0.66	0.87	7.92	3.12	High	Retain and Protect
4	<i>Platanus x acerifolia</i>	London Plane	0.76	0.78	9.12	2.98	High	Retain and Protect
5	<i>Platanus x acerifolia</i>	London Plane	0.86	0.92	10.32	3.20	High	Retain and Protect
6	<i>Corymbia maculata</i>	Spotted Gum	0.56	0.67	6.72	2.80	Moderate	Retain and Protect
7	<i>Corymbia maculata</i>	Spotted Gum	0.52	0.65	6.24	2.76	Moderate	Remove
8	<i>Acacia elata</i>	Mountain Cedar Wattle	0.52	0.63	6.24	2.73	Low	Remove
9	<i>Washingtonia robusta</i>	Washington Palm	0.52	0.73	3.00	2.90	Moderate	Transplant
10	<i>Washingtonia robusta</i>	Washington Palm	0.46	0.60	3.00	2.67	Moderate	Transplant
11	<i>Washingtonia robusta</i>	Washington Palm	0.41	0.62	3.00	2.71	Moderate	Transplant
12	<i>Sapium sebiferum</i>	Chinese Tallow Tree	0.46	0.60	5.52	2.67	Low	Remove
13	<i>Grevillea robusta</i>	Silky Oak	1.02	1.25	12.24	3.63	Moderate	Retain and Protect
14	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.22	0.26	2.64	1.88	High	Retain and Protect
15	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.06	0.09	2.00	1.20	Moderate	Retain and Protect
16	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.15	0.17	2.00	1.57	Moderate	Retain and Protect
17	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.44	0.52	5.28	2.51	Moderate	Remove
18	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.50	0.63	6.00	2.73	Moderate	Remove
19	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.51	0.62	6.12	2.71	Moderate	Remove
20	<i>Howea forsteriana</i>	Kentia Palm	0.15	0.26	2.00	0.80	Low	Transplant
21	<i>Howea forsteriana</i>	Kentia Palm	0.12	0.22	2.00	0.80	Low	Transplant
22	<i>Howea forsteriana</i>	Kentia Palm	0.14	0.19	2.00	0.80	Low	Transplant
23	<i>Howea forsteriana</i>	Kentia Palm	0.20	0.42	2.40	0.80	Low	Transplant

204

Demolition and clearance of existing structures is to be monitored and overseen by Project Consulting Arborist in this area. New terrace ground floor slab to float above existing ground levels supported on a minimum number of piles. Minimal root loss expected. [Current ground level approx 3.40 - new GF level 4.20]

Existing palms on site professionally transplanted and re-used in the proposed future landscaping works. They may need to be stored off site if space does not permit on-site storage during construction.

Trees shown to be removed are required to be removed as they are within the proposed building footprint.

Root investigations were undertaken on the western side of this tree, and no significant structural or lateral roots were observed during the inspection inside the boundary line from this tree. Basement and building construction therefore expected to have minimal root impacts. Canopy pruning to western side of tree to be undertaken to facilitate building and scaffold clearance. Refer to report for further information

Adjoining park trees are to be retained and protected. Minimal to no impacts expected.

Existing raised terraces and structures in this area. Roots are expected to be located under existing structures. Demolition is to be undertaken carefully and excavations that occur below street level to be minimised in this area. Demolition and clearance of existing structures is to be monitored and overseen by Project Consulting Arborist

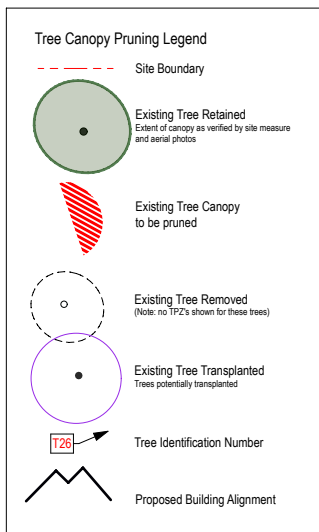
Pruning of canopy for building and scaffold clearances to be minimised. Refer to report for further information and extent of pruning to be undertaken. All pruning work to be monitored and overseen by Project Consulting Arborist

All street trees to be retain and protect. Site services to be routed to be outside of Tree Protection Area



4.3 Tree Canopy Pruning Plan

NOTE
Refer to the accompanying Arboricultural Preliminary Tree Report for full description of trees, measurements and methods used to assess the trees.



31 Cowper St & 2A-2D Wentworth Park Rd, Glebe - Tree Assessment Schedule

Tree ID	Tree Species	Common Name	Trunk Diameter Breast Height (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Retention Value	Tree Management Recommendation
1	<i>Platanus x acerifolia</i>	London Plane	0.78	0.92	9.36	3.20	High	Retain and Protect
2	<i>Platanus x acerifolia</i>	London Plane	0.73	1.07	8.76	3.40	High	Retain and Protect
3	<i>Platanus x acerifolia</i>	London Plane	0.66	0.87	7.92	3.12	High	Retain and Protect
4	<i>Platanus x acerifolia</i>	London Plane	0.76	0.78	9.12	2.98	High	Retain and Protect
5	<i>Platanus x acerifolia</i>	London Plane	0.86	0.92	10.32	3.20	High	Retain and Protect
6	<i>Corymbia maculata</i>	Spotted Gum	0.56	0.67	6.72	2.80	Moderate	Retain and Protect
7	<i>Corymbia maculata</i>	Spotted Gum	0.52	0.65	6.24	2.76	Moderate	Remove
8	<i>Acacia elata</i>	Mountain Cedar Wattle	0.52	0.63	6.24	2.73	Low	Remove
9	<i>Washingtonia robusta</i>	Washington Palm	0.52	0.73	3.00	2.90	Moderate	Transplant
10	<i>Washingtonia robusta</i>	Washington Palm	0.46	0.60	3.00	2.67	Moderate	Transplant
11	<i>Washingtonia robusta</i>	Washington Palm	0.41	0.62	3.00	2.71	Moderate	Transplant
12	<i>Sapium sebiferum</i>	Chinese Tallow Tree	0.46	0.60	5.52	2.67	Low	Remove
13	<i>Grevillea robusta</i>	Silky Oak	1.02	1.25	12.24	3.63	Moderate	Retain and Protect
14	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.22	0.26	2.64	1.88	High	Retain and Protect
15	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.06	0.09	2.00	1.20	Moderate	Retain and Protect
16	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	0.15	0.17	2.00	1.57	Moderate	Retain and Protect
17	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.44	0.52	5.28	2.51	Moderate	Remove
18	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.50	0.63	6.00	2.73	Moderate	Remove
19	<i>Corymbia citriodora</i>	Lemon Scented Gum	0.51	0.62	6.12	2.71	Moderate	Remove
20	<i>Howea forsteriana</i>	Kentia Palm	0.15	0.26	2.00	0.80	Low	Transplant
21	<i>Howea forsteriana</i>	Kentia Palm	0.12	0.22	2.00	0.80	Low	Transplant
22	<i>Howea forsteriana</i>	Kentia Palm	0.14	0.19	2.00	0.80	Low	Transplant
23	<i>Howea forsteriana</i>	Kentia Palm	0.20	0.42	2.40	0.80	Low	Transplant

206

No pruning required for T06. Major branches and foliage clear of proposed terraces. Scaffolding to be ceased and /or constructed around lowest branch if required and if it conflicts with tree. Foliage believed to be clear of any required piling equipment. If piles are required under canopy to support terrace construction then suitable low-height piling rigs are to be employed

Adjoining park trees are to be retained and protected.

Selective pruning to south side of the tree required due to building and scaffold clearance. All pruning work to be monitored and overseen by Project Consulting Arborist and to be undertaken according to AS 4373. Refer to report for further information.

Line of proposed scaffolding assumed to be a maximum of 2.0m off face of proposed building.

Minor canopy pruning to western side of tree is required to be undertaken to facilitate building and scaffold clearance. All pruning work to be monitored and overseen by Project Consulting Arborist and to be undertaken according to AS 4373. Refer to report for further information

All other smaller street trees to be retained and protect. No pruning expected to be undertaken or required.

Line of proposed scaffolding assumed to be a maximum of 2.0m off face of proposed building.



ARTERRA DESIGN PTY LTD ABN 40 069 552 610
SUITE 602 / 51 RAWSON STREET, EPPING, NSW 2121
P 02 9957 2466 F 02 9957 3977 W ARTERRA.COM.AU

REVISION	DESCRIPTION	CHKD	DATE
A	For Development Application	RWS	13/5/20

PROJECT & CLIENT
Glebe Mid-Rise, Cowper Street Glebe

NSW DPIE-Land and Housing Corporation

DRAWING TITLE
Tree Canopy Pruning Plan



DRAWING NUMBER
T-03

4.4 Tree Impact Assessment Schedule

31 Cowper St & 2A-2D Wentworth Park Rd, Glebe - Tree Assessment Schedule

Tree ID	Trees in Group	Tree Species	Common Name	Height (m)	Spread North (m)	Spread West (m)	Spread South (m)	Spread East (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Age Class	Current Vigour	Current Form	Noted Defects	SULE Rating	Retention Value	General Comments and Notes	Incursions and Impacts	Tree Management Recommendation
1	1	<i>Platanus x acerifolia</i>	London Plane	22.0	8.5	9.0	8.5	9.5	0.78	0.92	9.36	3.20	Mature	Excellent	Good	Bulges, Epicormic Growth, Pest/Disease	Long (>40 years)	High	Street tree. Previously drilled for insecticide treatment. Good tree, contributing to street and environmental amenity. Telstra services going beneath tree. Signs of possible anthracnose and powdery mildew noted during inspections.	Expected root disturbance and canopy pruning required to the southern side of tree. Theoretical incursion and root loss considered minor at 7%. Surface impacts closer to the tree to be managed. Acceptable level of canopy pruning to be undertaken.	Retain and Protect
2	1	<i>Platanus x acerifolia</i>	London Plane	18.0	7.0	6.0	6.0	6.5	0.73	1.07	8.76	3.40	Mature	Excellent	Good	Epicormic Growth, Bulges, Pest/Disease	Long (>40 years)	High	Park tree within garden area. Previously drilled for insecticide treatment. Good tree. Part of row planting along eastern edge of Park. Signs of possible anthracnose noted during inspections.	Minimal to no impact expected. Theoretic incursion of 1% due to basement excavation.	Retain and Protect
3	1	<i>Platanus x acerifolia</i>	London Plane	17.0	6.0	7.0	6.0	7.5	0.66	0.87	7.92	3.12	Mature	Excellent	Good	Epicormic Growth, Pest/Disease	Long (>40 years)	High	Park tree within garden area. Previously drilled for insecticide treatment. Good tree. Part of row planting along eastern edge of Park. Signs of possible anthracnose and powdery mildew noted during inspections.	Minimal to no impact expected.	Retain and Protect
4	1	<i>Platanus x acerifolia</i>	London Plane	19.0	8.0	7.5	7.5	7.5	0.76	0.78	9.12	2.98	Mature	Excellent	Good		Long (>40 years)	High	Park tree within garden area. Previously drilled for insecticide treatment. Good tree. Part of row planting along eastern edge of Park.	Minimal to no impact expected. Theoretical incursion of 3% due to basement excavation.	Retain and Protect
5	1	<i>Platanus x acerifolia</i>	London Plane	20.0	8.0	9.0	8.0	6.0	0.86	0.92	10.32	3.20	Mature	Excellent	Good		Long (>40 years)	High	Park tree within garden area. Previously drilled for insecticide treatment. Good tree. Part of row planting along eastern edge of Park.	Minimal to no impact expected. Theoretical incursion of 6% due to basement excavation.	Retain and Protect
6	1	<i>Corymbia maculata</i>	Spotted Gum	18.0	4.0	4.0	6.0	5.5	0.56	0.67	6.72	2.80	Mature	Good	Average	Epicormic Growth	Long (>40 years)	Moderate	Minor epicormic growth. Growing in very close proximity to adjoining minor retaining wall. Root likely to have escaped confines of site and be under nearby Mitchell Lane. Minor pruning for building clearance to eastern side.	Excavation to the north and east of tree. Incursion and root loss considered minor at 10% and considered acceptable. Ground levels to be retained around tree with the ground floor terrace floor level to be supported by piers and floating over existing surface with no excavation.	Retain and Protect
7	1	<i>Corymbia maculata</i>	Spotted Gum	19.0	4.0	5.0	6.0	3.5	0.52	0.65	6.24	2.76	Mature	Good	Average		Long (>40 years)	Moderate	Growing in very close proximity to boundary wall. Minor displacement of boundary wall noted. Minor pruning historically undertaken to northern side for building clearances.	Within building footprint	Remove
8	1	<i>Acacia elata</i>	Mountain Cedar Wattle	13.0	3.0	3.5	6.0	3.5	0.52	0.63	6.24	2.73	Mature	Fair	Poor	Tip Dieback, Asymmetric Canopy, Deadwood-Minor, Decay-Minor, Epicormic Growth	Medium (15-40 years)	Low	Asymmetric canopy to south-east. Minor tip dieback noted. Minor pruning to southern side.	Within building footprint	Remove
9	1	<i>Washingtonia robusta</i>	Washington Palm	13.5	2.0	2.0	2.0	2.0	0.52	0.73	3.00	2.90	Mature	Good	Average		Long (>40 years)	Moderate	Recommended to transplant and re-use elsewhere in final landscaping, however very close to boundary which will make potential transplant operations more difficult and costly.	Within building scaffold footprint. Candidate for transplanting.	Transplant
10	1	<i>Washingtonia robusta</i>	Washington Palm	12.0	2.0	2.0	2.0	2.0	0.46	0.60	3.00	2.67	Mature	Good	Average		Long (>40 years)	Moderate	Recommended to transplant and re-use elsewhere in final landscaping, however very close to boundary which will make potential transplant operations more difficult and costly.	Within building scaffold footprint. Candidate for transplanting.	Transplant
11	1	<i>Washingtonia robusta</i>	Washington Palm	12.5	2.0	2.0	2.0	2.0	0.41	0.62	3.00	2.71	Mature	Good	Average		Long (>40 years)	Moderate	Recommended to transplant and re-use elsewhere in final landscaping, however very close to boundary which will make potential transplant operations more difficult and costly. Slight lean towards north at top half of trunk.	Within building scaffold footprint. Candidate for transplanting.	Transplant
12	1	<i>Sapium sebiferum</i>	Chinese Tallow Tree	11.5	5.5	3.5	2.5	3.5	0.46	0.60	5.52	2.67	Mature	Good	Poor	Asymmetric Canopy, Lean-Minor, Epicormic Growth	Long (>40 years)	Low	Asymmetric canopy to the north-east.	Within building footprint	Remove
13	1	<i>Grevillea robusta</i>	Silky Oak	18.0	6.5	6.0	8.0	7.0	1.02	1.25	12.24	3.63	Mature	Fair	Average	Root Impacts, Decay-Minor, Tip Dieback, Cavity	Long (>40 years)	Moderate	Large street tree. Main branch crosses boundary at about 9.0m height above footpath level. Minor damage and decay noted at kerb side at ground level. Non-destructive root investigations undertaken adjacent to tree immediately inside boundary of the site. No significant or structural roots were observed with site. Trench dug to a depth of 600mm below existing ground level. Roots may be found below this level but it is believed to be less likely. Excavations within the site unlikely to significantly impact this tree.	Minimal to no root impact expected due to no roots found on property side of boundary during exploratory root investigations. Minor canopy pruning to be undertaken but considered relatively minor and acceptable.	Retain and Protect
14	1	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	12.5	2.0	2.0	2.0	2.0	0.22	0.26	2.64	1.88	Semi-mature	Good	Average	Branch Tearouts	Long (>40 years)	High	Street tree. Minor branch tear out to west.	Minimal to no impact expected.	Retain and Protect
15	1	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	6.0	1.0	1.0	1.0	1.0	0.06	0.09	2.00	1.20	Young	Good	Average		Long (>40 years)	Moderate	Recently planted street tree. Strong central leader, very little branching yet.	Minimal to no impact expected.	Retain and Protect
16	1	<i>Stenocarpus sinuatus</i>	Queensland Firewheel Tree	7.5	1.5	2.0	2.0	2.0	0.15	0.17	2.00	1.57	Semi-mature	Good	Average	Inclusions	Long (>40 years)	Moderate	Relatively recently planted street tree. Inclusions at primary branch junctions at 1.6m. Some mechanical damage to pathside western branch, otherwise generally good tree.	Minimal to no impact expected.	Retain and Protect
17	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	12.5	8.5	8.0	0.5	6.0	0.44	0.52	5.28	2.51	Mature	Good	Average	Asymmetric Canopy, Lean-Minor	Long (>40 years)	Moderate	Part of a group planted within an internal courtyard. Asymmetric canopy to north.	Within building footprint	Remove
18	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	8.5	5.0	8.0	5.0	0.50	0.63	6.00	2.73	Mature	Good	Average		Long (>40 years)	Moderate	Part of a group planted within an internal courtyard. Generally symmetrical and upright form.	Within building footprint	Remove
19	1	<i>Corymbia citriodora</i>	Lemon Scented Gum	14.0	7.0	7.0	5.0	4.0	0.51	0.62	6.12	2.71	Mature	Good	Average	Asymmetric Canopy, Lean-Minor	Long (>40 years)	Moderate	Part of a group planted within an internal courtyard. General lean and asymmetric canopy to north-west.	Within building footprint	Remove
20	1	<i>Howea forsteriana</i>	Kentia Palm	6.0	3.0	3.0	3.0	3.0	0.15	0.26	2.00	0.80	Mature	Good	Good		Long (>40 years)	Low	Part of a group planted within an internal courtyard. Could be easily transplanted and reused in final landscaping.	Within building footprint. Candidate for transplanting.	Transplant
21	1	<i>Howea forsteriana</i>	Kentia Palm	7.0	3.0	3.0	3.0	3.0	0.12	0.22	2.00	0.80	Mature	Good	Good	Pest/Disease	Long (>40 years)	Low	Within internal courtyard. Could be easily transplanted and reused in final landscaping. Some minor evidence of leaf blight or similar disease in lower fronds	Within building footprint. Candidate for transplanting.	Transplant
22	1	<i>Howea forsteriana</i>	Kentia Palm	7.5	3.0	3.0	3.0	3.0	0.14	0.19	2.00	0.80	Mature	Good	Good		Long (>40 years)	Low	Within internal courtyard. Could be easily transplanted and reused in final landscaping. Cordyline/Dracaena growing adjacent at its base.	Within building footprint. Candidate for transplanting.	Transplant
23	1	<i>Howea forsteriana</i>	Kentia Palm	6.0	2.5	2.5	2.5	2.5	0.20	0.42	2.40	0.80	Mature	Fair	Average		Long (>40 years)	Low	Within front courtyard in raised garden area. Could be easily transplanted and reused in final landscaping. Twin-trunked from base.	Within building footprint. Candidate for transplanting.	Transplant

4.5 Tree Data Summary Sheets

ID # 01
 Species: *Platanus x acerifolia*
 Common: London Plane

Height (m): 22.0
 DBH (m): 0.78 DGL (m): 0.92
 TPZ (m): 9.36 SRZ (m): 3.2
 Current Form: Good
 Current Vigour: Excellent
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: High



ID # 05
 Species: *Platanus x acerifolia*
 Common: London Plane

Height (m): 20.0
 DBH (m): 0.86 DGL (m): 0.92
 TPZ (m): 10.32 SRZ (m): 3.2
 Current Form: Good
 Current Vigour: Excellent
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: High



ID # 02
 Species: *Platanus x acerifolia*
 Common: London Plane

Height (m): 18.0
 DBH (m): 0.73 DGL (m): 1.07
 TPZ (m): 8.76 SRZ (m): 3.4
 Current Form: Good
 Current Vigour: Excellent
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: High



ID # 06
 Species: *Corymbia maculata*
 Common: Spotted Gum

Height (m): 18.0
 DBH (m): 0.56 DGL (m): 0.67
 TPZ (m): 6.72 SRZ (m): 2.8
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Moderate



ID # 03
 Species: *Platanus x acerifolia*
 Common: London Plane

Height (m): 17.0
 DBH (m): 0.66 DGL (m): 0.87
 TPZ (m): 7.92 SRZ (m): 3.12
 Current Form: Good
 Current Vigour: Excellent
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: High



ID # 07
 Species: *Corymbia maculata*
 Common: Spotted Gum

Height (m): 19.0
 DBH (m): 0.52 DGL (m): 0.65
 TPZ (m): 6.24 SRZ (m): 2.76
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Moderate



ID # 04
 Species: *Platanus x acerifolia*
 Common: London Plane

Height (m): 19.0
 DBH (m): 0.76 DGL (m): 0.78
 TPZ (m): 9.12 SRZ (m): 2.98
 Current Form: Good
 Current Vigour: Excellent
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: High



ID # 08
 Species: *Acacia elata*
 Common: Mountain Cedar Wattle

Height (m): 13.0
 DBH (m): 0.52 DGL (m): 0.63
 TPZ (m): 6.24 SRZ (m): 2.73
 Current Form: Poor
 Current Vigour: Fair
 Age Class: Mature
 SULE: Medium (15-40 years)

Retention Value: Low



ID # 09
 Species: *Washingtonia robusta*
 Common: Washington Palm

Height (m): 13.5
 DBH (m): 0.52 DGL (m): 0.73
 TPZ (m): 6.24 SRZ (m): 2.9
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: **Moderate**



ID # 13
 Species: *Grevillea robusta*
 Common: Silky Oak

Height (m): 18.0
 DBH (m): 1.02 DGL (m): 1.25
 TPZ (m): 12.24 SRZ (m): 3.63
 Current Form: Average
 Current Vigour: Fair
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: **Moderate**



ID # 10
 Species: *Washingtonia robusta*
 Common: Washington Palm

Height (m): 12.0
 DBH (m): 0.46 DGL (m): 0.60
 TPZ (m): 5.52 SRZ (m): 2.67
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: **Moderate**



ID # 14
 Species: *Stenocarpus sinuatus*
 Common: Queensland Firewheel Tree

Height (m): 12.5
 DBH (m): 0.22 DGL (m): 0.26
 TPZ (m): 2.64 SRZ (m): 1.88
 Current Form: Average
 Current Vigour: Good
 Age Class: Semi-mature
 SULE: Long (>40 years)

Retention Value: **High**



ID # 11
 Species: *Washingtonia robusta*
 Common: Washington Palm

Height (m): 12.5
 DBH (m): 0.41 DGL (m): 0.62
 TPZ (m): 4.92 SRZ (m): 2.71
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: **Moderate**



ID # 15
 Species: *Stenocarpus sinuatus*
 Common: Queensland Firewheel Tree

Height (m): 6.0
 DBH (m): 0.06 DGL (m): 0.09
 TPZ (m): 2 SRZ (m): 1.5
 Current Form: Average
 Current Vigour: Good
 Age Class: Young
 SULE: Long (>40 years)

Retention Value: **Moderate**



ID # 12
 Species: *Sapium sebiferum*
 Common: Chinese Tallow Tree

Height (m): 11.5
 DBH (m): 0.46 DGL (m): 0.60
 TPZ (m): 5.52 SRZ (m): 2.67
 Current Form: Poor
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

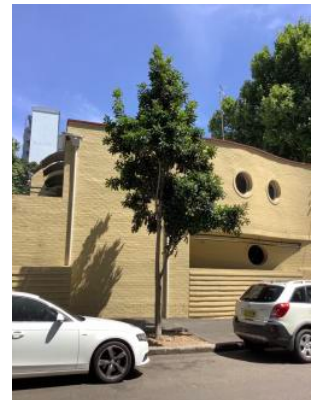
Retention Value: **Low**



ID # 16
 Species: *Stenocarpus sinuatus*
 Common: Queensland Firewheel Tree

Height (m): 7.5
 DBH (m): 0.15 DGL (m): 0.17
 TPZ (m): 2 SRZ (m): 1.57
 Current Form: Average
 Current Vigour: Good
 Age Class: Semi-mature
 SULE: Long (>40 years)

Retention Value: **Moderate**



ID # 17
 Species: *Corymbia citriodora*
 Common: Lemon Scented Gum



Height (m): 12.5
 DBH (m): 0.44 DGL (m): 0.52
 TPZ (m): 5.28 SRZ (m): 2.51
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Moderate

ID # 21
 Species: *Howea forsteriana*
 Common: Kentia Palm



Height (m): 7.0
 DBH (m): 0.12 DGL (m): 0.22
 TPZ (m): 2 SRZ (m): 1.75
 Current Form: Good
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Low

ID # 18
 Species: *Corymbia citriodora*
 Common: Lemon Scented Gum



Height (m): 14.0
 DBH (m): 0.50 DGL (m): 0.63
 TPZ (m): 6 SRZ (m): 2.73
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Moderate

ID # 22
 Species: *Howea forsteriana*
 Common: Kentia Palm



Height (m): 7.5
 DBH (m): 0.14 DGL (m): 0.19
 TPZ (m): 2 SRZ (m): 1.65
 Current Form: Good
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Low

ID # 19
 Species: *Corymbia citriodora*
 Common: Lemon Scented Gum



Height (m): 14.0
 DBH (m): 0.51 DGL (m): 0.62
 TPZ (m): 6.12 SRZ (m): 2.71
 Current Form: Average
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Moderate

ID # 23
 Species: *Howea forsteriana*
 Common: Kentia Palm



Height (m): 6.0
 DBH (m): 0.20 DGL (m): 0.42
 TPZ (m): 2.4 SRZ (m): 2.3
 Current Form: Average
 Current Vigour: Fair
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Low

ID # 20
 Species: *Howea forsteriana*
 Common: Kentia Palm



Height (m): 6.0
 DBH (m): 0.15 DGL (m): 0.26
 TPZ (m): 2 SRZ (m): 1.88
 Current Form: Good
 Current Vigour: Good
 Age Class: Mature
 SULE: Long (>40 years)

Retention Value: Low